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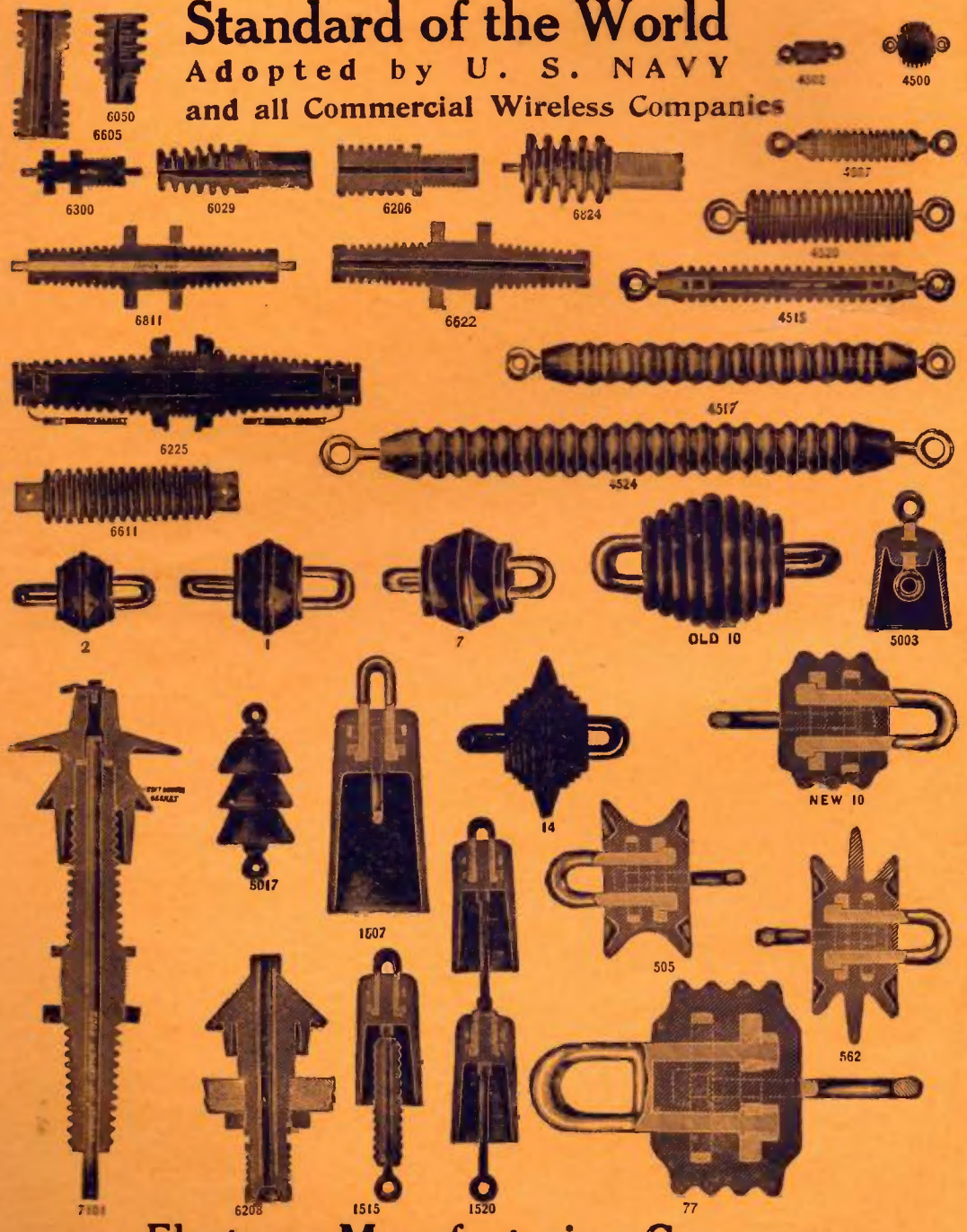

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"THE ELECTRICAL MAGAZINE FOR EVERYBODY"

Edited by H. Gernsback

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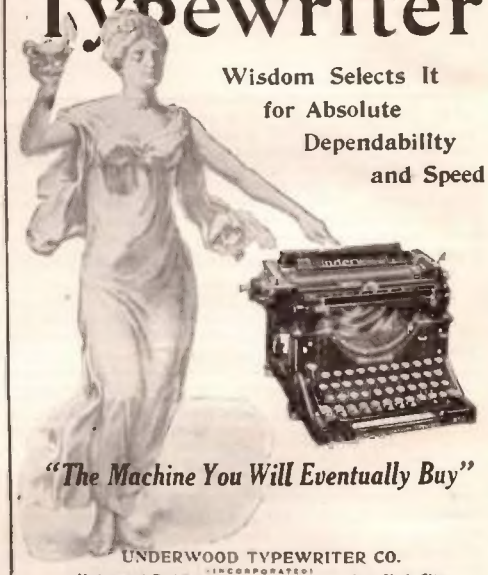

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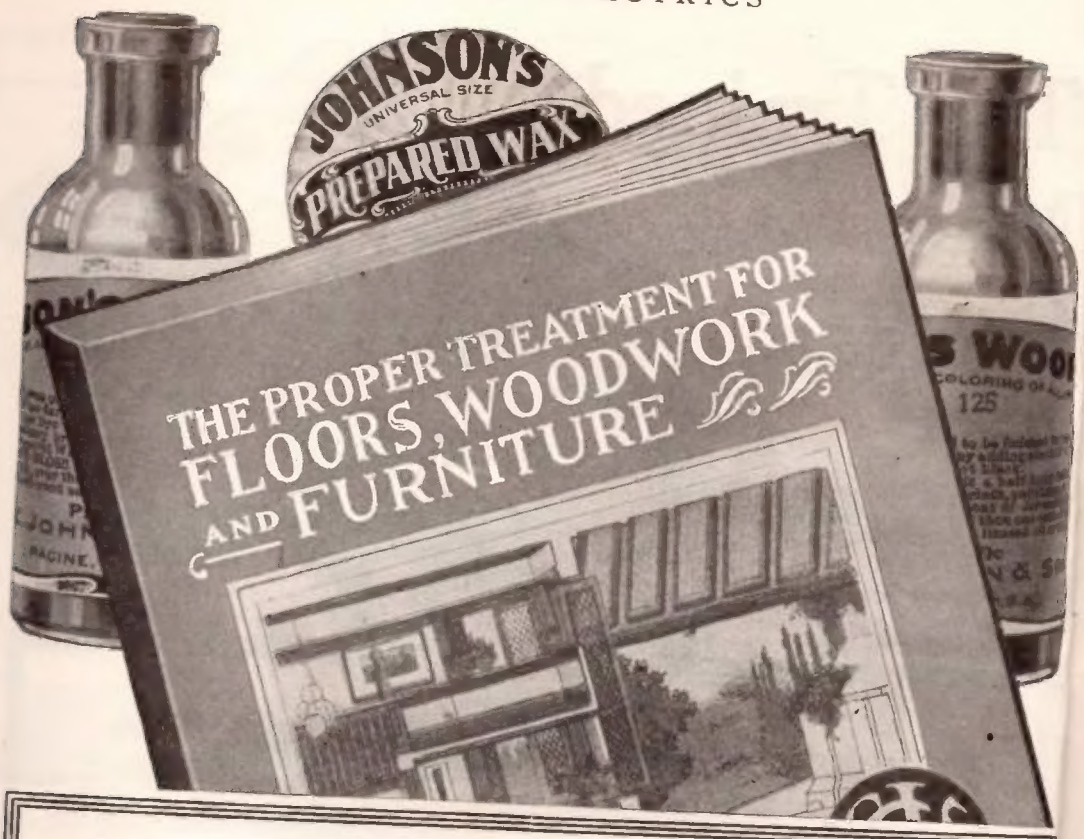

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The Practical Electrician

A Popular Course in Electricity on the Construction of Electrical Apparatus and Experiments to be Conducted with them

By PROFESSOR W. WEILER, of the University of Esslingen, (Germany)
Translated by H. GERNSBACK

CHAPTER IV

(Continued)

117. Double Lever Rheostats

THE two levers shown in Fig. 183 are always connected together at the center. This form of rheostat was invented by Mr. C. Erhardt.

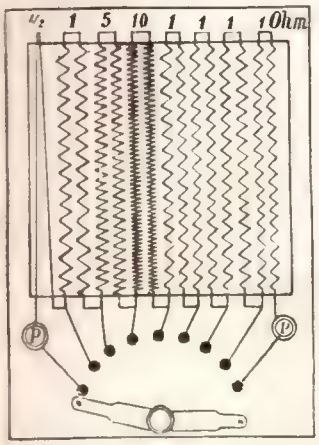


FIG. 183.

P and P are the binding posts to which the wires of the circuit are connected.

In this form of rheostat all the resistance, no matter in which position, that is included *between* the two levers, is out of the circuit. This may be easily understood by studying the illustration. Very fine regulation is possible with this form of rheostat and the resistances that may be obtained expressed in ohms are as follows:

½, 1, 1½, 2,.....4½, 5½, 6½,..... 10½, 14, 14½.....20½.

The jump from 10½ to 14 may be reduced by putting more resistance units between 1 and 5.

The resistances are constructed of German silver wire and may be made by winding the wire over a pencil, etc. To get good results the spiral when thus wound should be left on the pencil or metal rod for several weeks as they will then keep their shape much better.

118. Bifilar Winding

For most measuring instruments it is necessary to have a special kind of winding in order not to get any magnetic or inductive effect which would in most cases be detrimental to other instruments placed in the neighborhood of the measuring instrument; and for that reason the bifilar winding is mostly employed in resistance boxes used for measuring purposes. To do this, instead of winding the

single wire, wind a double wire as shown in Fig. 184, at I. This is easily done by doubling the wire exactly in the middle and winding the two ends simultaneously either on the spool, cord, or making an open winding as shown in Fig. 184.

It is, of course, necessary that the resistance of the wire is known accurately and the correct length is taken, based on the knowledge of the resistance. Most any kind of good resistance wire, such as manganin, German silver, climax, etc., may be used such as is sold by dealers in the open market.

119. Resistance Measuring Cases and Boxes

By using a differential galvanometer or else a Wheatstone bridge, to measure the resistance, the following resistances are made up:

0.1 Ohms	0.2 Ohms	0.2 Ohms	0.5 Ohms
1 "	1 "	2 "	5 "
10 "	10 "	20 "	50 "
100 "	100 "	200 "	500 "
1000 "	1000 "	2000 "	5000 "

As shown at II of Fig. 184, the resistance wires are wound on pieces of wood or spools, *r*, and the ends of the resistance wires go to the copper pins, K, to which they are carefully soldered. The

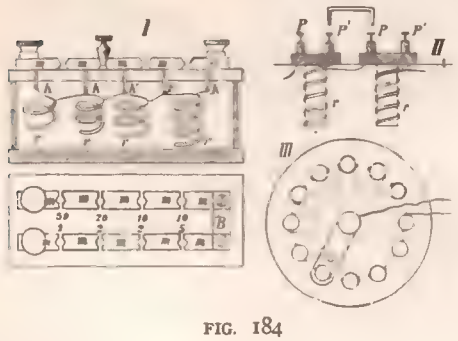


FIG. 184

copper pins in turn are screwed or soldered to the brass blocks *m*. These brass blocks are separated, as shown, and are mounted on a fibre or hard rubber base and attached to same from underneath by means of small brass screws. In the conical holes between every two brass blocks a conical brass plug is inserted which fits the hole with some friction in order to make good contact. This is shown at I of Fig. 184.

It is apparent that the coil connected to two of the blocks, *m*, between which a plug is inserted, is disconnected from the circuit. By withdrawing the brass plugs the various resistances are easily put in circuit and thus most any resistance can be obtained.

Several sets of resistance spools may be connected by means of the bridge B. This is the so-called Siemens arrangement.

Another construction is shown at III, Fig. 184, and the resistance here is changed by means of the central lever while the ends of the windings go to the switch points as shown.

120. Liquid Resistances

Very cheap as well as efficient variable liquid resistances are made by using two zinc plates dipped in a solution of sulphate of zinc. By changing the distance between the plates more or less resistance is introduced.

A good arrangement is also had by placing one zinc plate on the bottom of a tall glass jar having another circular zinc plate arranged movably to work up and down in a vertical direction and the resistance in this case can be changed quite readily. It may be noted that the zinc plates form electrodes which cannot be polarized because just as much zinc is carried to the cathode as is dissolved in the anode and the surface of zinc is formed over and over again. For constant use such a rheostat is not to be recommended.

121. Uses of Rheostats

In order to make incandescent lamps burn dimmer or brighter, or to protect them from burning out where the voltage is too high, a rheostat must be used. If lamps are used in connection with batteries it is always necessary to have a rheostat in circuit as the initial voltage of the battery is quite high in most batteries and if the lamps are placed directly across the terminals of the battery the lamp or lamps might burn out. Here the rheostat is an absolute necessity. Many lamps, especially the carbon filament lamps require more current as they are used, and the older the lamp the more current is required. Here the rheostat will do good service.

Most arc lamps in order to burn steady must have the correct voltage and here the rheostat is often quite necessary. For electroplating it is absolutely necessary to use a rheostat for the current intensity must be regulated very carefully if a good metallic deposit is desired.

Most dynamos require the addition of a theorist to work to their highest efficiency, which will be treated in a later chapter.

122. Safety Fuses

The fuse was perhaps first invented by Edison and is absolutely necessary to protect the circuits in case the current becomes too high. It finds its greatest use in buildings where it protects the lamps or motors as well as the main line. If, for instance, the main line current should become strong enough to burn out the lamps or armature of the motor in a building, the fuse would promptly burn out, thereby protecting the house. On the other hand if in the house itself, a short circuit should be had and there were no fuses, it is self-evident that the armature of the dynamo at the power station would burn out or if the current is supplied by storage batteries, the batteries would be harmed a great deal. For that reason fuses have been introduced and have been found to be the cheapest means of disconnecting the supply line from the main line at the instant the current becomes too strong. Another important mission of the fuse is that it protects the wire from becoming over heated if too strong a current should be drawn through same, and which might cause a fire.

Fuses may be made of most any metal, but they are usually made of a fusible alloy, although abroad, pure silver wires are very often used. In this country lead alloy wires are mostly used.

123. Fusible Alloys

The number of parts given in the tables below are taken so that there are always a total of 1,000 parts when the different alloys have been mixed. The melting points are in degrees Centigrade.

Lead	397	434
Cadmium	71	67
Bismuth	532	499
Melting point	89.5°	95°

Lead	250	312
Bismuth	500	500
Tin	250	188
Melting point	95°	95°

Lead	269
Zinc	42
Tin	689
Melting point	168°

Lead	249	251	260	343	344	267	250
Cadmium	108	102	70	131	62	100	125
Bismuth	501	504	522	488	500	500	500
Tin	142	143	148	138	94	133	125
Melting point	65.5°	67.5°	68.5°	68.5°	67.5°	63°	68°

In order to prepare these alloys the metals are melted in a cast-iron pot or crucible and the different metals are added in the following order: Lead, cadmium, bismuth, the last metal to be added being the tin. It is wrong to put the metal melting easiest as for instance, the tin, in the pot first.

Fig. 185 shows the simplest kind of fuse being made of two brass blocks to which the main wires are connected while the fuse wire is connected on top. In most cases the diameter of the fuse wire is calibrated in such a manner that it fuses when the current becomes a little stronger than it is supposed to be normally. For lighting purposes and power purposes a fuse must be placed in each branch of the circuit.

124. Electromagnets

Origin of the electromagnet. Brewster and Sturgeon, 1825.

If we take a soft iron rod and wind around it a helix of insulated copper

FIG. 185.

wire, and if an electric current is sent through the wire, the iron rod becomes temporarily magnetized. It keeps its magnetism until the moment when the current is interrupted. If the iron rod is not very soft it will still be magnetic even after the current has been disconnected. This phenomenon is usually termed as "remanant" or residual magnetism.

125. Construction of Electromagnets

Electromagnets are used to-day in a great many thousand different applications and often take most curious shapes. It all depends on what they are to be used for, and what purposes they are supposed to serve.

The iron is perhaps the most important part of an electromagnet and only the best soft iron should be used. As a precaution the iron should be heated to a red heat over a charcoal fire and the iron then left in the fire which is allowed to die out gradually of its own accord and very slowly. The slower the cooling the softer the iron will be. Very often iron for high-grade electromagnets is heated

to red heat in a vacuum which does away with oxidation and makes towards a better product.

A straight soft iron rod is usually insulated by means of paper, shellac or varnished cloth, fibre, rubber, etc., and on top of this the wire convolutions are wound. It is necessary that the wire be well insulated or else short circuits between layers or turns may easily occur. If there are a great many layers it becomes necessary to use a spool on which to wind the wire or else there would be nothing to hold the sides of the completed winding. These spool heads as they are called may be made of most any insulating material such as wood, fibre, hard rubber, glass, porcelain, etc., all depending on the use and purpose of the electromagnet.

FIG. 186

It is the custom to let the iron rod project some fraction of an inch through the spool heads. Most electromagnets are bipolar, or of the so-called horseshoe type. It is unusual to make a horseshoe electromagnet in one piece, as it is easier to wind the two cores separately and then the cores are either screwed or riveted to a common iron plate which for all practical purposes is as good as making the core in one piece.

127. Forms of Electromagnets

In the usual electromagnet we distinguish its important parts as follows:

In Fig. 186, i is the connecting piece, K represents the legs or core, while in a dynamo or motor they are usually called the field cores. Around these, the field windings or coils are placed or wound. The two poles are shown at P.

In the case of the dynamo, as in the illustration, AR represents the armature which rotates between the two pole pieces and in the usual electromagnet the straight piece, AR, is also termed the armature.

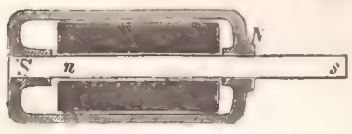


FIG. 187

The armature is usually an iron mass which may carry wire or not and the purpose of the armature is to absorb in itself the magnetism which passes between the poles of the electromagnet. In dynamos the armature is made to rotate between the poles and thereby generate the current of the machine.

The mission of the electromagnet is either to pull an armature towards the pole pieces, the power being used for pulling weights, or to close contacts, etc., while in a dynamo the rotating armature produces electric currents. The electromagnets find use in thousands of different industries and arts, mainly in dynamos and motors, in telegraphy, registering apparatus, signaling apparatus, electric clocks, etc.

Fig. 187 shows the so-called bell magnet, mantle magnet, or plunger magnet, and it will be seen that the windings are located in the inside of the iron bell. This form of electromagnet is very efficient as no magnetism is lost through leakage. These electromagnets are usually very powerful.

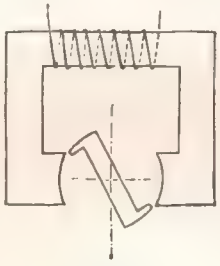


FIG. 188

In Fig. 188 we have a rotating armature and if this armature is a magnet itself it will produce a current in the winding. On the other hand we may put the winding on the armature which may be of soft iron and if the field is itself magnetic, a current will also be produced.

(To be Continued.)

HERE AND THERE

Telephone operators in Egypt are required to speak English, French, Italian, Greek and Arabic.

The British post office has adopted the night letter-telegram service for telegraph lines in the British Isles.

The busiest time in all the year in the telephone exchange is the tenth or eleventh day before Christmas.

A wireless station is being built at London which is expected to provide direct communication with New York.

Electricity will be the only power used at a lock large enough for vessels 1,000 feet long that will be built at the Pacific end of the Panama Canal.

Wireless Station at the University of Michigan

By B. N. Burglund

THE transmitting set is composed of a large condenser which is variable and composed of copper coated flat glass plates, 30" x 30" and fifty-six of these plates can be used in series or multiple as different experiments require. These plates are coated and insulated in such a manner that there is practically no loss due to brush discharge. Each plate is connected to a switch, so as to be cut in or out as the occasion requires. All plates are connected with cable, very heavy but finely divided. Fig. 4 shows how these leads are fanned out and soldered to the copper coatings, also the condenser frame and the switches "Bus Bars" and connecting leads and the primary and secondary of the oscillation transformer.

The square case back of the oscillation transformer contains the rotary spark gap and motor. This spark gap is rather unique and will be described in detail later. The transformer is of the open core type, and in connection with an auto-transformer is variable from ½ to 15 kw. The transformer is not shown in the picture.

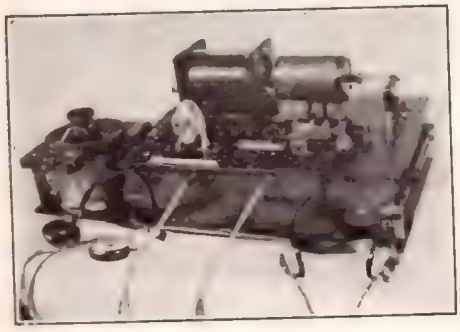


FIG. 1

The oscillation transformer is made like a large loose coupler. The secondary slides on the brass tube shown in the center. Fig. 2 shows the secondary of the oscillation transformer set for loose coupling.

FIG. 2

Figs. 2 and 3 give a very good idea of the size of the set. Fig. 3 was taken by the light from the spark gap. The spark wheel was running about 3,000 R.P.M. and a spark was made that lasted about 0.1 part of a second. Note the strong actinic light. An ammeter placed in the oscillating circuit shows more than 150 amperes circulating through the gap.

The round white spot under my chin is caused by the spark reflecting back from the surface of the camera lens and gives a fair idea of the size or the volume of the spark as viewed through a smoked glass. (The picture is of yours truly standing at the edge of the transmitter case.)

Figure 1 shows one of the receiving

sets used for long distance work. This is a combination set arranged so as to be used as single or double slide tuning coil or loose coupler and a combination of both. We also can use most any de-

FIG. 3

tector, for instance, carborundum, perikon or audion, in fact, any type of crystal can be used and tested with this set. On the loose coupler, it will be noticed

FIG. 4

that no sliding contacts are used. (We don't believe in them.) All taps are made on switches that have positive contact. This set can also be used to measure the wave length of incoming signals as well as to measure their strength. Ten sets of telephones can be used on this set at once. Note how the telephones are attached. When the plug is

FIG. 5

inserted it cuts in that particular telephone automatically and when the plug

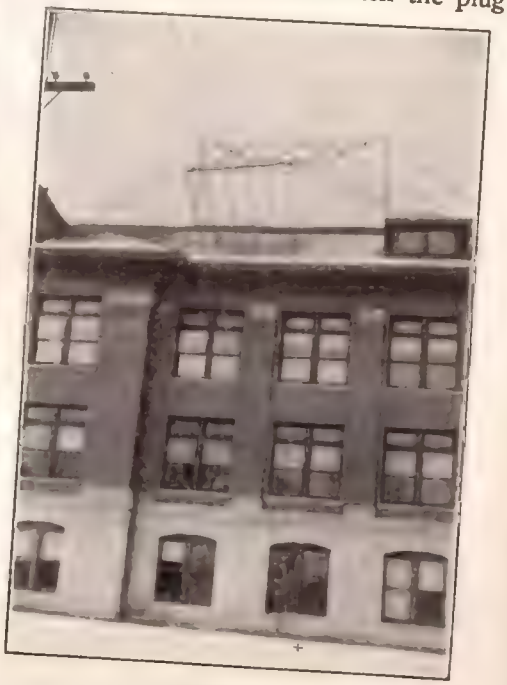


FIG. 6

is taken out it closes the circuit again.

(*Continued on page 1262.*)

Measurement of Antenna Insulation and Earth Plate Resistance

By Stanley E. Hyde

Antenna Insulation

IN the construction of aerials for radio transmission it is of the utmost importance that the antenna possess a high-insulation resistance, so that the leakage of the current from the antenna wires will be reduced to a minimum. To measure the insulation resistance of the antenna proceed as follows: the antenna is disconnected from the sending inductance and also the ground wire. Connect the ground wire to one side of a supply of direct current capable of giving an E. M. F. of 200 to 500 volts. The other side, preferably the positive pole if the system is grounded, is connected to the antenna lead through a sensitive galvanometer which has been previously calibrated as a micro-ammeter, i. e., one that will register a current of one millionth ampere, see Fig. 1. For example, suppose the galvanometer reading was 10 micro-amperes and the voltage of the dynamo or other source of current, was 500. Then by Ohm's Law

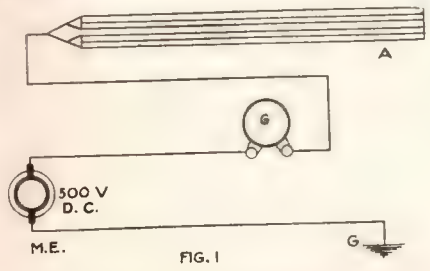


FIG. 1

$R = E \div I$; and substituting the above values, we have $R = \frac{500}{0.000010} = 50{,}000{,}000$ ohms, or 50 megohms (1 megohm = 1 million ohms).

This means that 10 one-millionths of an ampere is making its way to the earth through a resistance of 50,000,000 ohms. It does this by way of the wooden pole, guy wires and other supports that hold up or insulate the aerial. The insulation resistance will be found to vary a great deal according to the moisture present in the atmosphere, thus on rainy or foggy days the resistance will be low, while on dry days it will be found to be very high. For this reason rubber insulated wire would make a better antenna than bare wire, but the cost of the rubber covered wire would offset the advantage of having greater antenna insulation. It must also be remembered that although the aerial may possess a good insulation resistance it may not be insulated well for high frequency oscillations, for if the lead to the antenna runs parallel to other wires or metallic work that is grounded, oscillations will be set up in these by electro-magnetic and electrostatic induction and energy absorbed as effectually as if they were in actual metallic contact. For this reason the guy wires supporting the masts of radio stations should be cut up into short lengths by means of insulators so that but little of the induced current will escape into the earth.

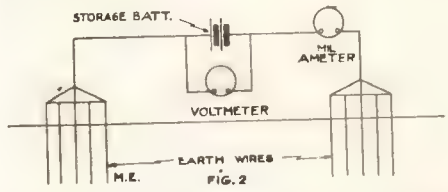


FIG. 2

Another factor in high powered stations where large quantities of current are oscillating in the antenna is a loss of energy from brushing, and this usually occurs at the end of the aerial away from the instruments. If sharp points are left, when soldering the wires, these act the same as a lightning rod, in that they let energy escape from the sharp point out into the surrounding air. No matter what system is being used, the wires at the far end of the antenna should invariably all be soldered together for the reason that if two sets of wires are used they may not be of the same capacity or wave length.

Measurement of Earth Plate Resistance

The measurement of the earth plate resistance can be made in the following manner: When laying down the wires half of them are brought to one terminal and the other half brought to another terminal, normally, of course, all of the wires are connected together. Across these terminals is connected a storage battery shunted by a voltmeter and in series with a milli-ammeter (an ammeter that will read in thousandths of an ampere). Ohm's law is again applied and the resistance found as before. Fig. 2 shows the connections. It is advisable to use storage cells, as their internal resistance is negligible as compared to other batteries.

Another method of measuring this resistance is by the Wheatstone's Bridge method, shown diagrammatically in Fig. 3 and illustrated by the photo, Fig. 4. A weak dry battery should be used so that the current will not injure the resistance coils, as dry batteries when new will develop from 25 to 30 amperes. From left to right in the photo are a dry cell, Wheatstone's Bridge (Post Office type), galvanometer and standard resistance box for checking up the readings on the bridge, when in doubt as to the accuracy of the readings. The two sets of earth wires are connected to the binding posts on the bridge where the unknown resistance is ordinarily connected and the usual balancing of the bridge is gone through, depending on the make of the bridge. If the earth that the wires are buried in is damp, it is advisable to first connect the galvanometer to the two sets of wires and note whether the needle deflects to a

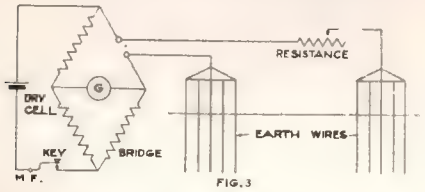


FIG. 3

considerable extent or not; and if it does, it shows that the two sets of wires act similar to a battery, the damp earth acting as the electrolyte, or the earth currents intercepted by the wires causes a difference of potential between the terminals of the two sets; and a small current is thus formed that would make errors when balancing the bridge. By connecting in the standard resistance box, resistance is cut in till there is no deflection of the galvanometer, usually about 5,000 ohms being enough. This resistance must, of course, be subtracted from the original reading of the bridge and the remainder will be the resistance offered by the earth between and around the earth wires. A peculiar effect was noted in carrying on these experiments in that when the galvanometer was connected direct to the earth wires the needle kept swaying back and forth at irregular periods, very similar to the action of a volt-meter when it is being used

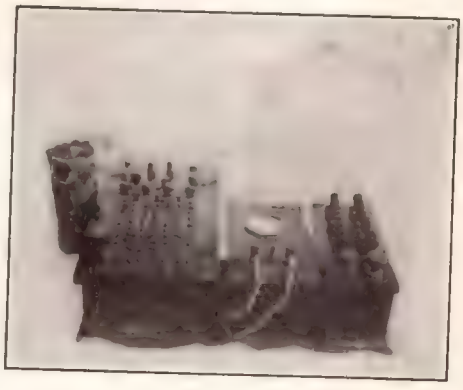


FIG. 4

where the load is constantly varying. This is due probably to earth or other currents that pass across the path of the current that is passing between the plates or wires and either oppose or help it. Fig. 5 illustrates the arrangement for studying these earth currents. Most any sensitive galvanometer will do for this purpose, and the greater the distance between the plates or wires the greater will be the deflection and variation of the needle.

The writer tried an experiment to determine how much the resistance would increase between two plates of the same size as their distance apart was increased, but instead of the resistance increasing it was found to DECREASE. This at first sounds ridiculous, but the experiments were gone over many times and checked up with the standard resistance box and the averages taken so that there could not have been any errors. If 3,800 ohms was found to be the resistance when the plates were six feet apart, then they were disconnected from the bridge and the standard resistance box cut in with

the same resistance; this proving whether the reading was correct or not. From an inspection of Figs. 6 and 7 it will be shown theoretically that the resistance should decrease as the distance between the plates increases for the reason that the cross sectional area of the earth increases faster than the distance between the plates, thus giving more conducting earth for the current lines to travel from one plate to the other. If any one doubts that the current spreads out beyond the width of the plates as shown in Figs. 6 and 7, let him try the experiment illustrated in Fig. 8. In a flat bottomed porcelain dish about a foot and a half square containing moist earth are placed two small metallic electrodes, A and B. To these are connected wires that lead to a source of alternating or pulsating current. If alternating current is not obtainable a buzzer can be used by connecting the wires from A and B to the interrupter contacts of the buzzer which can be operated with dry batteries. Now, if the tips of a pair of wireless telephones are moved around in the field of the current the loudest signals will be heard in the telephones when the tips are situated as shown by the points C and D, thus showing that

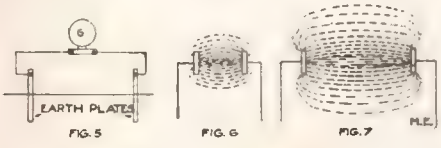


FIG. 5 FIG. 6 FIG. 7

the current spreads out when passing from one pole to the other, and if the tips are brought to the center of the dish the buzzing will be at a minimum. This will prove conclusively that the current does spread out in curved lines when traveling from one electrode to the other and the farther the electrodes are apart the greater they will spread.

A clean level stretch of ground was selected for the experiment and one plate buried up to its top edge in the dry soil and equal distances laid off every two feet. For the first distance the other plate was buried at one foot distant and the resistance noted, which was 7,290 ohms. The plate was then pulled up and buried again at two feet and the resistance noted, it being 4,250 ohms, showing a drop in resistance of 3,050 ohms due to the current having a greater cross-sectional area of conducting earth to travel through. The rest of the data up to and including ten feet are shown in the tabulated results. After a distance of two feet it was necessary to connect in the

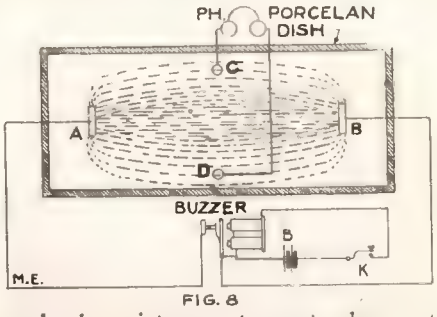


FIG. 8

standard resistance to cut down the earth currents which affected the galvanometer. At a distance of 25 feet it was impossible to obtain results for no matter how much resistance was introduced from the standard the earth current would deflect the needle.

The same experiments were tried in earth a few feet away that had previously been soaked with water and the results were the same with the exception that the resistance was very low compared with the resistance in dry earth and the values fell very slowly as shown in Table 1. One of the plates is shown standing behind the galvanometer and resistance box in the photo. This would show theoretically that if a perfect ground connection could be made the resistance of the earth at say a mile distant, would be practically nil, but of course it is impossible to have perfect earth connection and the intervening soil would not be the same, for in some places it would be dry and rocky and at others moist. But it is evident that it pays to have a large ground capacity and to keep the same moist so that the radiating qualities of the station will not be unnecessarily impaired.

Table 2 shows the Specific Resistance of Water and Soils.

TABLE I

Resistance of Dry Earth at Distances of:		Resistance of Damp Earth	
1 Ft.	7290 Ohms	200	Ohms
2 "	4250 "	199.5	"
4 "	4080 "	199.5	"
6 "	3800 "	199.	"
8 "	2600 "	199.	"
10 "	2300 "	188.7	"

(*Continued on page 1264.*)

ONLY WOMAN HOLDING RADIO OPERATOR'S LICENSE

We present herewith a photograph of Mrs. F. B. Chambers, Philadelphia's only licensed woman operator. Mrs. Chambers took the regular examination, along with several hundred men and boys, at the League Island Navy Yard and was given her license without question, as it is said her knowledge of wireless apparatus was superior to that of most of the men who applied. So far as we know she is the only woman who holds a license as a radio operator. Mrs. Chambers has a very complete outfit which she describes as follows:

Photo, Underwood & Underwood, N. Y.

FIG. 1

"The wireless outfit I am using, and which is shown in the accompanying photograph is not an amateur station, but a technical experiment station for the development of radio communication; and, radio instruments for commercial work, as you will see by the picture. I am afraid that if I did not mention the class of station, it might confuse the reader, when I describe the instruments. First I will take up the antenna,—this is composed of 16 copper wires, 75 feet between spreaders. The spreaders are 24 feet long, and behind the spreaders, hard rubber insulators 1-1¼ inch in diameter, and 16 inches long, with brass eye-bolt in each end, are cut into the wires. The height of the antenna from the ground is 85 feet at one end and 92 feet at the other. From one end 8 lead-in wires come down to within about 40 feet of the ground, where they join a 7-strand cable equivalent to No. 6 B & S, the total length of wire in the antenna being about 1,600 feet.

The transformer used is a 1 kw. open core type, glass plate condensers—of which there are four, an oscillation transformer or loose-coupled helix, so arranged that the coupling is easily varied, a heavy key, a quick throw transfer switch, and a straight spark gap; although we have tried all kinds of gaps—straight, quenched, rotary and series, and the gap we favor most is the series gap of from 3 to 4 sparks; as that has given us the greatest radiation with a given input of power. This outfit is good for 100 miles at all times, but as we are located near the Philadelphia Navy Yard, and would not wish to interfere, almost all of our experimenting—and also transmitting, is done with from 200 to 400 watts. Fig. 2 shows the 1 kva. motor-generator which we use, and which is 220 volts D. C. side, 110 volts,

FIG. 2

9.1 amperes A. C. side, and 120 cycles.

The receiving instrument consists of a double loose-coupled set, three variable plate condensers of 31 plates each, valve detector and the well-known "Improved Navy Standard" type 'phones, of 3,200 ohms resistance; and I do not hesitate to say that the receiving range of this station is second to none, as we read

(Continued on page 1264.)

A Barbed Wire Fence Telegraph Line for Amateurs

The U. S. Signal Corps Field Induction Telegraph and Field Buzzer

By Lieut. G. R. Guild, U. S. A.

In time of war, for its advanced field lines, the United States Signal Corps utilizes two different methods of line communication, each of which has its own particular function to fulfill and both of which may be considered more or less oddities of telegraphic equipment.

One of these methods is termed the "field induction telegraph" and the other the "field buzzer." The latter is becoming fairly well known among militia troops, but the former is hardly known at all outside of the regular service.

The distinction between the two lies principally in the quality of the audible signal which each produces. The signals with the induction telegraph being received by means of an ordinary 4-ohm sounder, while those with the buzzer are received by means of a telephone head receiver and are identical in effect with those produced in a wireless head set.

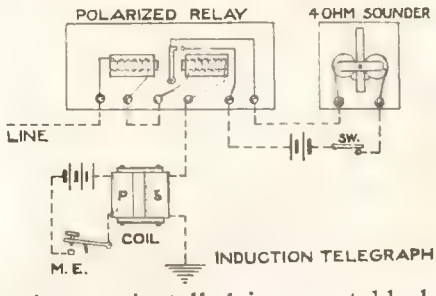
Advanced field lines must often be laid directly on the ground, crossing and recrossing roads and other lines, and often covered with mud and water. As the insulation of these field lines frequently becomes scraped off, lines become broken and have to be hastily patched, and even at times a line may be broken in two and the ends separated by a few yards, it is evident that the ordinary commercial telegraph circuit could not hold up under such conditions. The two circuits described in this article will, however, give entirely satisfactory results under such trying circumstances.

An amateur of an experimental turn of mind who desires to establish a line between his own home and that of one of his friends, and yet do so at a minimum expense of line and upkeep, will find either the induction telegraph or the buzzer an interesting experiment and one which will give perfect satisfaction. Especially is this true concerning young amateurs who live in the country and who desire to use a barbed wire fence for a line, for such a line may be several miles long.

The easier circuit to construct and operate is that of the buzzer, but its disadvantage lies in the fact that the distant operator must be at or near his instrument in order to hear his call, while the call given by the induction telegraph can be heard all over the house. Hence the amateur should consider these facts in choosing between the two circuits.

The Induction Telegraph

In the army field set all the instruments and batteries necessary for one



station are installed in a portable box weighing about twelve pounds. The set is always ready for use by merely attaching the line and ground wires to their binding posts.

This set, with only *three dry cells* for its line circuit, will operate at least 300 miles over a line strung on poles, and will operate a few miles over a bare wire laid directly on the ground. The writer succeeded in operating these sets through a non-inductive resistance of 100,000 ohms on the three dry cells per station.

An experimental set can be easily made which will give the same results.

The principle of operation of an induction telegraph circuit is that an induced, or secondary, current of high voltage and low amperage is put to line through polarized relays by means of an induction coil. The make and break of the primary circuit through the induction coil causes a momentary in-

duced current in the secondary circuit and the direction of this induced current at "make" is the opposite to that at "break."

An ordinary telegraph relay does not respond to a change of direction of current through its coils, but a polarized relay does, consequently if an induced current be passed through a polarized relay and if this current changes direction in exact accordance with the "make" and "break" of its primary current by means of a key, it follows that the relay armature will act in unison with the key; that is, it will "make," or close, the local sounder circuit at the "make" of the distant key, and break it when the key breaks.

The instruments for one station are: One polarized relay (any commercial type or a home-made one); one 4-ohm sounder; one small induction coil; one telegraph key with its closing switch lever removed; three dry cells for the primary circuit, one or two dry cells for the local sounder circuit.

Of the above instruments the induction coil is the only one which is not commercial and must be specially constructed.

The easiest way to construct such a coil is to obtain a choke coil, such as is used by telegraph companies, and rewind one of the coils.

Failing this means, however, a coil may easily be constructed in the following manner:

Obtain two pieces of soft round iron, say each 3½ inches long and ⅜ of an inch in diameter, for cores. Have a hole bored one-half an inch into the ends of these cores and threaded to take a small bolt. On one core wind about 200 feet of No. 16 insulated copper wire. This will be the primary coil. Wind the other core with very fine hair-like magnet wire, the finest that can be obtained—No. 36, if possible—until the diameter of this coil is about the same as that of the primary coil. This will be the secondary coil. Bind the two coils in a permanent parallel position by means of two pieces of flat soft iron attached to the ends of the cores by means of small bolts passing through these flat pieces of iron near their ends and into the threaded holes in the ends of the cores.

This will complete the induction coil, which is in reality a small closed core transformer.

Connect three dry cells, the primary coil of the induction coil, and the telegraph key all in series. This is known as the primary circuit.

Connect the relay coils (by means of their proper binding posts), the secondary coil of the induction coil, the line, and the ground all in series. This is known as the secondary circuit.

Connect the relay armature contacts (by means of their proper binding posts), the 4-ohm sounder, and two dry cells all in series. This is known as the local sounder circuit. A switch in this circuit is advisable, though not necessary, to keep from running down the dry cells in case the relay armature tongue falls to closed contact when the set is not in use.

Adjust the polarized relay so that its armature will have very little play and will remain in a neutral position, that is, will remain on either contact as placed by the finger.

Short circuit the "line" and "ground" connections until that station operates correctly, then remove the short circuit.

Now, upon depressing the key the primary circuit is closed and a current will flow through the primary coil. During the minute interval of time that this current is rising to its maximum an induced current will flow through the entire secondary circuit, and by passing through the polarized relays of both stations will operate the armatures of these relays *in a particular direction,* thus closing the local sounder circuits and operating the 4-ohm sounders. If the relay armatures have been adjusted to a neutral position they will remain on the proper contact until the distant key "breaks," when another induced current in the secondary circuit, having a direction opposite to the former one, will "break" the relay armature contact and open the local sounder circuit.

Hence both sounders will respond to either key. A little difficulty will be experienced at first. If the sounder lever *rises* when the key is depressed, reverse the polarity of the batteries in the primary circuit, or the direction of the current through the primary coil, or the direction of the induced current through the relay. If the sounder rises

when the *distant* key is depressed, reverse the "line" and "ground" connections or reverse the direction of the induced current through the relay. A little patience and experimenting will soon cause both stations to operate correctly.

When the key is not in use the primary circuit should always be kept open if dry cells are used.

The results that can be obtained with the induction telegraph are interesting and surprising.

For those who desire to enter this subject more deeply the 1912 volume of the Annual Proceedings of the American Institute of Electrical Engineers contains an exhaustive discussion of the induction telegraph, with both simplex and duplex circuits.

The Field Buzzer

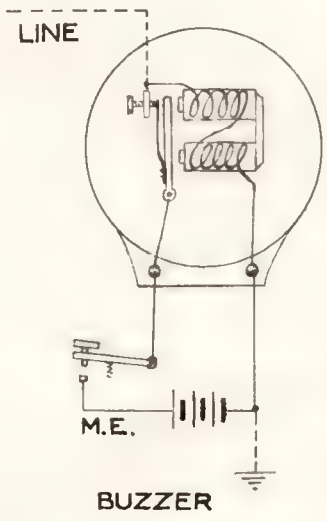
Like the induction telegraph, this little instrument is also the friend of the United States soldier when he is far in advance of, or out of reach of, the regular telegraph lines.

The new instruments just adopted by the United States Signal Corps are about the size of a cigar box and are very light. They contain a few small dry cells placed end to end, in a manner similar to the arrangement of a multi-volt cell in certain pocket flash lamps; a key; a small coil and interrupter, and a head telephone receiver. In addition they also contain means for ordinary telephony, but this will not be discussed in this article.

The buzzer will operate under conditions such that no other known form of wire telegraphy can be used. Lines lying on the ground and totally submerged in water for several miles at a stretch have been successfully operated over by means of this instrument. Wagons passing over a line stretched across a road have cut it in two, the ends have separated by several yards, and still the distant receiving operator has been able to receive an important message.

Under favorable conditions the range of the buzzer is probably half that of the induction telegraph, or 150 miles, possibly more with the new instruments. Yet it is not distance that is particularly desired to be overcome by the buzzer so much as it is bad conditions, short circuits, grounds, breaks, etc., of lines approximating twenty miles in length.

The theory of operation of the buzzer is that if a current passing through a coil of wire on an iron core is suddenly broken the sudden collapsing of the lines of force set up by this current will, in cutting the turns of wire of the coil, produce in that coil another current which is known as the current of self-induction. This current of self-induction will flow in the same direction at "break" as that of the original current and will tend to prolong that current after the "break" has been made in the circuit. The result is that, with the high voltage of this self-induced current, the air gap at the key or interrupter is broken down and a spark is produced as this current "jumps the gap."



Now, if the electrical energy which causes this spark can be sent out on the line instead of wasting itself producing a spark, we would get an electrical impulse of momentary duration but of considerable voltage, which, in passing through the coils of a telephone receiver, would actuate the diaphragm of that receiver. If these impulses follow one another at brief intervals in a successive train the diaphragm of the telephone receiver will, in responding, produce a buzz, and we would have, as our instrument, the buzzer.

When the key of the buzzer is depressed it closes the circuit through the

(*Continued on page 1262.*)

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Vol. V MARCH No. 12

EDITORIAL

THIS is a continuation of our former editorial on inventions yet to be invented.

Our readers take a keen interest in inventing electrical devices and are always bent on finding something new of use to humanity or of advantage to the art.

We have requests almost daily in one form or another, where inventors desire to know what is best to invent and what is likely to be of greatest benefit not alone as far as the invention itself is concerned, and its uses, but as to the financial rewards the invention-to-be will bring.

We present a few more suggestions herewith, every one of the subjects as presented being worth large sums of money if they can be evolved successfully.

One of the most important electrical articles is the platinum contact point. One electrical company in New York City uses about one and one-quarter million dollars' worth of platinum contact points a year and it would naturally pay an inventor to invent a point made of some new material or composition that will take the place of the expensive platinum, which to-day sells at about $58.00 an ounce and is still rising.

Of late patents have been taken out on substitute points made of molybdenum; also tungsten points have been used, but both these materials are so refractory that it is extremely hard to form them, especially in the case of the former material of which it is almost impossible to make points commercially. The latter material costs even more than platinum, consequently it is not a great improvement. Furthermore, tungsten oxidizes where platinum does not.

From the above it will be seen that a gold mine is struck the moment a cheap unoxidizable contact point has been evolved.

Another important device needed in every wireless station is a reliable cheap call apparatus that will work under all circumstances and on most of the usual wave lengths. It must be sure and must work satisfactorily on board a ship without "going off" when the ship rolls or pitches.

A most important invention will be a cheap primary battery containing no harmful acids, which does not give off fumes, which is not hurt by short circuits, which is cheap in replenishing and which gives a voltage not below 1 with a corresponding high amperage for a small size.

Another highly important article may be termed a composition mass, this material being used a great deal in almost every branch of electrical industry. It is used for bases, bushings, knobs and usually takes the place of hard rubber. While there are some very satisfactory products, they are far from being the ultimate and are far from being cheap. Furthermore, the lower priced ones are affected by heat and acid while most of the recent compounds evolved that will stand heat are very expensive and hard to make. It is quite possible to produce some compound from very cheap ingredients that will compete with porcelain or glass, still having all the good properties of hard rubber. Experiments along these lines are very fruitful.

A Radio High Frequency Buzzer

By Stanley E. Hyde

SOME remarkable results have been accomplished in radio transmission by the use of small spark coils on large aerials, these feats being lauded to some extent by the persons engaged in making the long distance records, but little or nothing has been said about tests that have been carried on in the U. S. Navy with specially constructed buzzers for transmitting purposes. These buzzers have been used successfully on distances of fifty miles and more and their action is very regular and the emitted tone

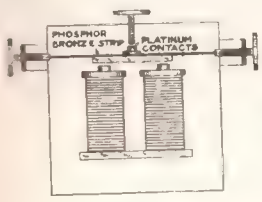


FIG. 1

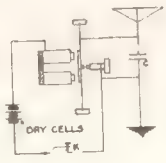


FIG. 2

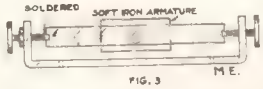


FIG. 3

pure. In the accompanying photo and drawing are shown one of these transmitting buzzers designed on a somewhat smaller scale than those used in the Navy, but it will give excellent results when used with a condenser whose capacity is about 0.008 mfd. (Murdock receiving condenser.) The condenser shown in the photo is of this type and will answer the purpose admirably.

The construction of the buzzer is shown in Fig. 1. It consists of a large size electric bell with a specially constructed armature carrying large make and break contacts. The arrangement of the armature is shown in Fig. 3. A brass bar about 3/32 inch thick and a quarter inch wide is bent as shown to suit the base that the electro-magnets are on and held to it by machine screws through holes drilled in the magnet base. The piece that holds the soft iron armature is a piece of springy sheet phosphor bronze, and it is soldered into slots in the set screws. The slots are sawed into the ends of the screws for about 1/32 inch, and this prevents the spring from being wrenched off the screw ends when the armature is under tension. The general dimensions are not given because the electro-magnets will vary in size and the experimenter generally makes up his own dimensions when using another's idea.

The soft iron armature's length and width will be governed by the diameter of the electro-magnet pole tips and their distance apart; it being also soldered to the vibrating strip. In the middle of the strip on the other side from the armature is soldered either a silver or platinum contact, silver being preferred because it is less expensive and easier to obtain. The other contact, that which is on the end of the adjustment screw, is also of silver or platinum and the screw may be mounted, either by a hard fibre mounting on the same base as the magnets, or on the support that the whole is screwed to. Both contacts should be heavier than the ordinary bell contacts so that they will give more sparking surface when the circuit is broken. A space of ⅛ inch is left between the armature and the pole faces on the magnets.

When assembled the buzzer is connected as shown in Fig. 2, the aerial and ground taken off from each side of the condenser respectively. In operation when current in the coils of the electro-magnets has been built up, there is quite a large amount of energy stored in the

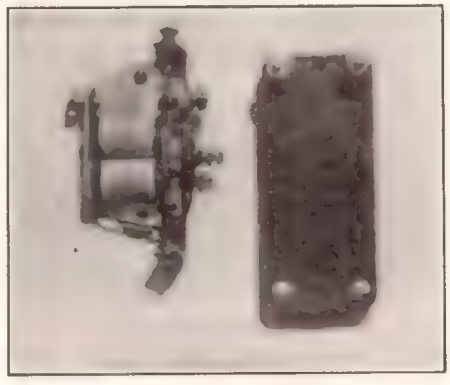


FIG. 4

magnetic field and when the armature is pulled toward the poles and the circuit broken, this magnetic field collapses in upon the turns of the coils and induces a strong electro-motive force that charges the condenser which then discharges its energy into the antenna, it having enough inductance in itself to form oscillations that are more or less persistent in character. When the adjustment screw is rather tight the sound heard at the receiving station will resemble a quenched spark. This buzzer can be used on a large antenna without interfering with other stations as the tuning is very sharp and the wave length will approximately equal the natural wave length of the antenna as no concentrated inductance is used to make a closed circuit. The buzzer under discussion connected to an antenna 300 feet long and 125 feet high sent messages a distance of 30 miles on a 6-volt storage battery using ½ ampere, or one watt for 10 miles.

Where does the spark coil come in?

FIRST WIRELESS STATION INSTALLED IN A CHURCH

The Rev. Horace K. Holtzinger, of Philadelphia, has installed a complete wireless outfit in the Fifth Street Methodist Temple, where in connection with his church work, he will begin classes in wireless telegraphy as an inducement for

Photo, Underwood & Underwood, N. Y.

DR. HOLTZINGER RECEIVING MESSAGE

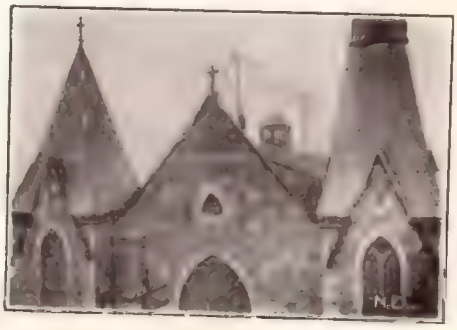
the boys and young men to come to church.

One photograph shows the aerial on the roof of the church and the other shows the clergyman in the study of the church receiving a message.

Dr. Holtzinger writes us concerning his station and his boys as follows:

"The aerial consists of four wires, stranded, each sixty-five feet long, eighty-five feet above the sidewalk. The lead in wire is also stranded and is rubber covered. The four wires are evenly spaced on six foot spreaders, and well insulated.

The receiving instruments are: loose coupled tuner, fixed condenser, cup detector, arranged so that any sensitive mineral can be used and if desired min-



Photo, Underwood & Underwood, N. Y.

THE AERIAL ON THE CHURCH

erals can be changed quickly, pair of 2,000 ohm receivers. The best results, so far have been obtained with silicon, copper pyrite and zincite. The maximum receiving radius so far is approximately 500 miles, but we expect to obtain better results as we continue to experiment.

The sending station at present is merely a practice station. It is composed of ¾-inch spark coil operated on dry batteries, spark gap and Morse key. It will carry about five miles (on 4 cells). As the class becomes proficient we will install higher power sending apparatus.

The equipment was manufactured by the F. B. Chambers Co., of Philadelphia, and is giving complete satisfaction.

The class is enthusiastic. Young men are spending their time in a helpful environment and their application and interest will doubtless bring good results, spiritually, intellectually and possibly financially."

It is reported that the captain of the steamer *Buy Hoga,* anchored in the port of Algiers, was suddenly surrounded by his Chinese crew and menaced with death. Seeking assistance he hit upon the idea of pounding on the wireless. The Chinese became frightened by the buzzing noise of the apparatus and skipped ashore.

Gaston Planté

GASTON PLANTE was born April 22, 1834, at Orthez (Department Basses—Pyrenées), France.

He started his scientific career under Edmond Becquerel at the Conservatoire des Arts et Metiers in Paris. His work on electricity began in the year 1859 and later on he published a book on researches on electricity in the year 1879 and a second edition was subsequently published in 1883.

An honorary diploma was awarded him in 1881 at the Parisian Exposition of Electricity which is the highest honor awarded at that time in this branch.

From the Academy of Arts he received the prize Lacaze and from the Society for the Encouragement for National Industry, he also received the Ampère medal.

He died at the age of fifty-five years in the year 1889.

GASTON PLANTÉ

Although there had been some inventors, especially Sinstedten in 1854, who experimented with lead plates in sulphuric acid, none of the forerunners of Planté achieved anything worth mentioning, he being the first scientist who investigated the storage cell thoroughly. He certainly is the first who understood the chemical as well as the electrical processes of accumulators, which are very complicated. Thus Planté found that it was necessary to charge and discharge the plates which were sunk in a sulphuric acid electrolyte time and again in order to bring about the proper deposit on both plates, in other words to make them "active." He observed that the plate to which the positive current was connected took on a deposit which is formed of peroxide of lead, while the negative plate was not charged at all and remained pure lead, which, however, became spongy through charge and discharge.

Even today the Planté type of storage battery is considered superior to the so-called pasted storage battery plates in which the peroxide of lead and spongy lead are applied artificially.

The great advantage of the Planté type storage battery is that the peroxide of lead, when it is evolved directly from its plate, adheres much better to the latter, than in the case of those plates which have the peroxide of lead deposited or filled in the plates by artificial methods.

Oscillation Transformer Variometer Type

By Everett W. Davis

SINCE the new law restricts amateurs in wireless telegraphy to a sharply tuned transmitting wave, this necessitates the use of an oscillation transformer instead of a helix under ordinary conditions. The oscillation transformer described as follows has been designed for the above purpose

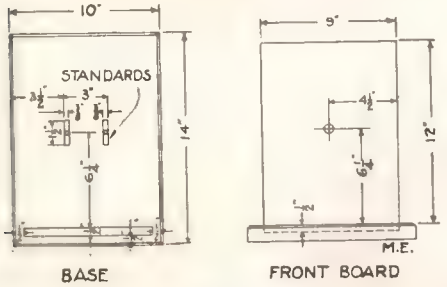


FIG. 1

and is inexpensive in construction and efficient in operation.

The base is a hard wood board 14 inches by 10 inches, ¾ of an inch thick and beveled on the four edges ¼ of an inch. A front upright board 12 inches by 9 inches, ½ inch thick, is glued to one end of the base. These boards are cut and drilled to dimensions shown in Fig. 1.

Procure two cylindrical rings of insulating material, one 10½ inches and the other 8 inches in diameter. Each should be 3 inches wide and have a wall 3/16 of an inch thick. Paper strips soaked first in thin shellac and

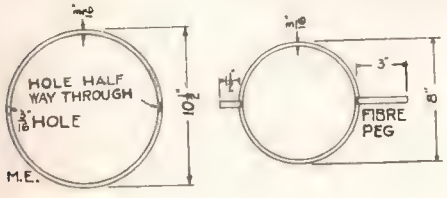


FIG. 2

then wound to the above dimensions, will serve the purpose satisfactorily.

The primary coil is wound on the *outside* of the large ring and the secondary coil on the *inside* of the small ring. Each consists of four turns of No. 6 copper or aluminum wire spaced ½ inch apart, leaving a margin of ½ inch from each edge. Fasten the wire to the cylinders at every half turn by a loop of fine wire (No. 24 or 26) passed through the wall of the ring. Place a large binding post at one of the ends of each winding.

Equi-distant from the edges of the primary ring locate a point that is also in the middle of the space which lies between two consecutive turns of wire. Drill a hole there 3/16 of an inch in diameter and also another one half way through the opposite inside wall of the ring. At a convenient place on the outside of the secondary ring bore, with the same 3/16 inch bit, a hole partly through, and also on the opposite side, half way around the paper ring, do the same. It is quite necessary that these holes should be drilled accurately and in the exact place; otherwise the secondary ring will not turn freely within the primary. Take two

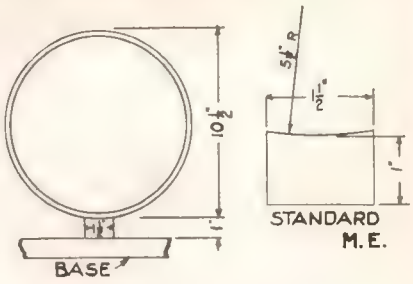


FIG. 3

pieces of fibre rod 3/16 of an inch in diameter, one 3 inches and the other 1¼ inches long, and glue them in the holes bored in the outside of the secondary ring. Details are illustrated in Fig. 2. This is done after the secondary ring is placed inside the primary. If desired, the fibre rod may pass straight through both sides of the secondary.

Make two standards of wood or better fibre, the shape shown in Fig. 3, and fasten them to the outside of the primary ring by screws, as also illustrated in Fig. 3. Assemble the parts as shown in Fig. 4.

A cardboard or fibre washer should be glued to the rod, close to the back of the front upright board to keep the secondary ring from slipping out of

place. The ring should turn somewhat stiffly, so as to be able to maintain adjustment without the use of a spring or snap catch.

Fasten a hard rubber knob and a small brass pointer to the end of the fibre rod which comes through the

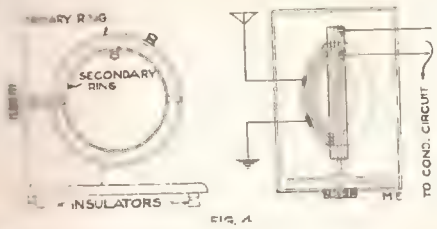


FIG. 4

front board, and around this should be placed a calibrated scale in order to determine the degree of coupling between the primary and secondary coils.

Connection with the primary and secondary coils is made with flexible cable and clips as usual, taking care to have the primary leads as short as possible. For the sake of insulation fasten a porcelain knob insulator under each corner of the base.

This oscillation transformer has ample inductance for tuning to 200 meters wave-length and with the proper degree of coupling between the primary and secondary coils, found by experiment, a pure wave will be transmitted if also a rotary or quenched spark gap is used. It may be used on sets up to 1 kw. capacity.

A LONG SCALE, D. C. DEAD BEAT, MOVING COIL INSTRUMENT

The Record dead beat moving coil instrument for the measurement of direct current amperes or volts is outwardly distinguished from all direct current moving coil instruments hitherto available by the extraordinary length of its scale. As shown in Fig. 1, the latter extends over 300 degrees, as compared with 90 degrees, the maximum scale arc provided in any other modern direct current moving coil instrument. To attain this scale length necessitates a special arrangement of the air gap and moving coil, which arrangement constitutes the characteristic feature of the new instrument.

In the type of direct current moving coil instrument hiterto standard, a soft iron cylinder has been mounted concentrically with cupped pole pieces, so as to form an annular air gap in which swings a moving coil embracing the cylindrical core and pivoted in the axis of the latter (see also Fig. 5).

The arrangement of the Record air gap and moving coil is shown in Figs. 3, 4 and 6. One pole is provided with top and botthom extension plates, between which penetrates the second pole piece. The pole pieces are bored out to accommodate the inner edge of the moving coil and the spindle to which the latter is attached.

Referring to Figs. 5 and 6, it will be seen that in the ordinary moving coil instrument, the sides of the coil are parallel to the spindle and move in a uni-

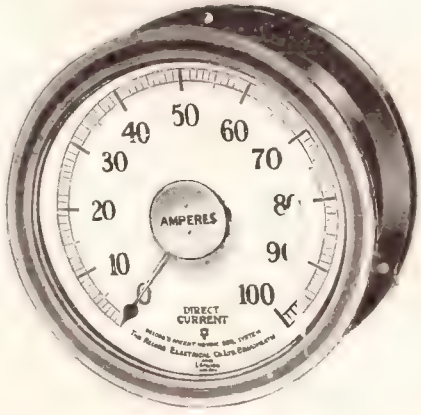


FIG. 1

form radial field perpendicular to the spindle, whereas, in the Record instrument, those edges of the moving coil which are perpendicular to the spindle move in a broad but shallow annular air gap traversed by a uniform field parallel to the spindle.

In the case represented by Fig. 5 the maximum angle through which the coil can be deflected, without leaving the uniform air gap field, is AOC, and, if this angle be made much greater than 90 degrees, such magnetic leakage occurs directly from pole to pole that the field in the air gap is no longer uniform. The pointer deflection in this type of instrument is therefore practically limited to 90 degrees.

In the Record instrument, however, the coil can move through the angle ABC (300 to 330 degrees) without encountering appreciable variation in the air gap field. So obvious is the means—now that we know it—whereby this desirable

result is attained, that we can only wonder it has not been discovered before. It is again a case of having the egg but being unable to make it stand on end.

Some readers will remember that a number of years ago, Mr. H. Davies introduced a long scale moving coil instru-

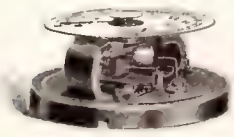


FIG. 2

FIG. 3

ment, the general arrangement of which was as indicated in Fig. 7. In this case it was impossible to arrange a longer scale arc than about 180 degrees, without incurring serious leakage of flux from FF, and hence a non-uniform air gap field.

Again only one side of the Davies moving coil was operative in producing a deflecting torque; the remaining three sides, though electrically imperative, simply offered idle resistance and reduced the sensibility of the instrument.

Recapitulating, the ordinary moving coil instrument hitherto standard, employs usefully the two longer sides of the moving coil (Fig. 8a), and uses two air gaps in series; the Davies instrument employed usefully only one of its longer sides (Fig. 8), but had only a single air gap; the Record instrument, however, employs usefully its two longer sides (Fig. 8c), and uses two air gaps in parallel—*i. e., in effect half the minimum air gap required for mechanical clearance.* Since the Record moving coil embraces only a plate, instead of a cylindrical core, the length of the idle copper is less than half as great as in the ordi-

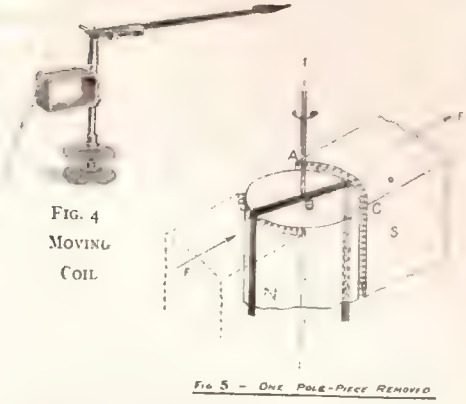


FIG. 4 MOVING COIL

FIG. 5 — ONE POLE-PIECE REMOVED

nary moving coil instrument, and fact together with the low magnetic luctance of the two air gaps in par (which low reluctance also favors manency in the field magnet), makes Record instrument extremely sensi As a matter of fact, more than t times the maximum scale deflection h erto usual in this class of instrun is provided without exceeding the o. volt terminal potential difference rec mended by the Engineering Standa Committee. The full scale deflec torque is approximately 1 gramme-c timeter—*i. e.,* 0.5 gramme-centimeter gramme weight of moving system.

In the ordinary moving coil inst ment the weight of the moving c

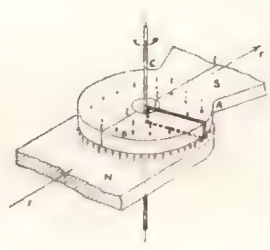


FIG. 6

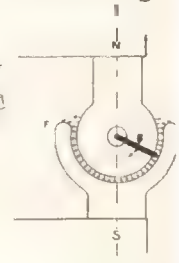


FIG. 7

is symmetrically disposed about t spindle in the plane of the coil, but the Record instrument the coil is e tirely overhung—a fact which cons erably simplifies the balancing of t moving system. The pointer is s diametrically opposite to the movi coil, balancing being completed by adjustable counterweight under the i ner end of the pointer. The latter of aluminum and moves close over t scale plate. The scale itself is mark outside the calibration figures, whi are set far enough in to clear t "blob" of the pointer. By this mea maximum scale length is secured, t gether with maximum readabilit however acute the angle of observatio

The permanent magnet forms a C shaped girder of great strength, t which the various component parts c the instrument are attached, as show in Fig. 2. The terminals and the mag net system are insulated from th frame casting by mica washers an plates which are tested to 2,000 volt The moving system is controlled b two spiral phosphor-bronze springs, ar ranged differentially, so that one i coiled up while the other is unwound

A particularly uniform controlling torque at all temperatures and deflections is thus secured and the spring control per gramme weight of moving parts is exceptionally high. The temperature coefficient of the moving coil is swamped in the usual manner by a manganin series resistance. The damping of the instrument is uncanny in its accuracy; it has never been our

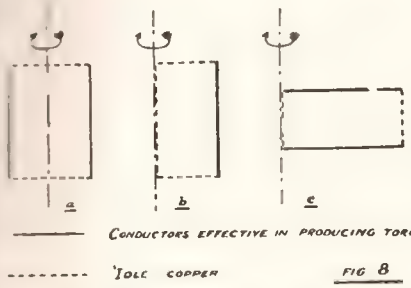


FIG 8

pleasure to see an instrument of this class more perfectly dead beat. A zero adjustment is provided, though prolonged tests, including heating to 212 degrees F. and cooling to 32 degrees F. with the pointer held to full deflection, show it to be unnecessary.

The instrument is very easily unbuilt, should this be necessary at any time for repair; the central pole piece, which is embraced by the moving coil, is split parallel to the direction of the magnetic flow (in the plane, ttt, Fig. 6). This division involves no appreciable distortion of the air gap flux since it is in the neutral magnetic zone. The large clearance between the ends of the moving coil and the iron which it embraces permits considerable slackening of the bearings without risk of the coil fouling the pole pieces; this clearance does not detract from the sensibility of the instrument.

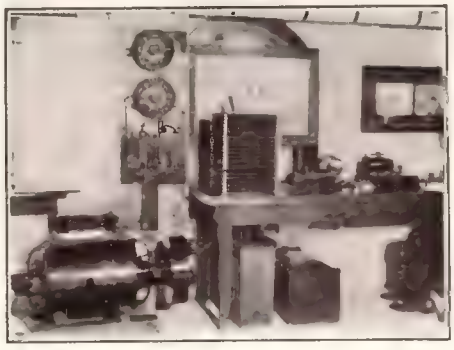
In the simplicity of the instrument lies the surest augery of its success. No untried scientific principle or constructional material is employed, but, by mechanical improvements and increased electrical efficiency, the limitations of the ordinary moving coil instrument are in most respects avoided, and in no respect are less favorable results secured.—*Electricity.*

NEW Y. M. C. A. RADIO INSTALLATION

The Los Angeles Y. M. C. A. Radio School is located on the top floor of the eleven story building of the Los Angeles Y. M. C. A. Occupying, as it does, this high and more or less isolated position, it is in the most favorable position for use as a wireless station.

This school was established only after long and earnest study of conditions and consultation with Government and commercial wireless officials, all of whom were most encouraging in their statement of the need for the school and their willingness to aid graduates whenever possible.

Besides the individual practice sending and receiving equipment, the station is equipped with a standard two kilowatt Marconi sending and receiving set. This apparatus consists of a sending set using a three kilowatt motor generator with a rotary disc spark attached to the shaft, switchboard with regulating and protective devices, two kilowatt transformer, plate condenser in oil, oscillation transformer, and break-in key. The receiving appa-


THE RADIO APPARATUS

ratus consists of the Marconi loose-coupled tuner used in connection with both the magnetic detector and those of the crystal type.

The antenna of the station, located as it is on masts reaching some forty feet from the topmost part of the building, seems to be admirably adapted to its purpose. The damping effect of the nearby steel office buildings is almost unnoticed. About four hundred feet of stranded phosphor bronze wire

(*Continued on page 1304.*)

TESTING 100,000-VOLT INSULATORS

On high voltage transmission lines the insulators are of great importance and must have a high factor of safety. Before installing, each is tested to a somewhat greater voltage than that

with which it is to be used. The illustration shows a test where the voltage has just passed the insulation limit and the current can be seen beginning to break across.

BARBED WIRE FENCE TELEGRAPH

(*Continued from page 1253.*)

coil and its interrupter. The interrupter continually "interrupts," or makes and breaks, this circuit as long as the key is depressed, and the current of self-induction is forced to go out on the line at each interruption and operates the diaphragm of the distant telephone receiver as just described. The interruptions are very rapid, hence the impulses that go to line follow one another at very minute intervals and produce a buzz rather than a series of clicks in the distant receiver.

Hence the theories of operation of the induction telegraph and the field buzzer are somewhat analogous, the former operating on an induced current, the latter on a self-induced current.

An amateur buzzer line is very easy to construct and can be made to operate over a barbed-wire fence "line" to perfection.

All that is needed for one station are: One ordinary iron kitchen buzzer or vibrating bell with the tapper removed; one inexpensive telephone head receiver; one key with closing switch lever removed, and three dry cells.

Connect the buzzer, key and dry cells in series so that when the key is depressed the buzzer will "buzz." Now solder a piece of wire to the small adjustable post against which the spring of the interrupter strikes. This will be the "line" wire. Put the telephone receiver for that station in series with the line.

Attach a "ground" wire to that binding post of the buzzer which leads to the buzzer coils, not the interrupter. Connect the distant station in the same manner and the line is ready for operation.

If the line is a very short one, as, for instance, one room to another, insert some resistance in the line. A 16 c. p. lamp would do, an 8 c. p. lamp would be better.

The more rapidly the interrupter vibrates the higher and better will be the note in the head receiver, consequently a high pitched buzzer is better than a low one. The little nickel-plated buzzers (about 1½ inches long and ⅜ inch wide) are the best for this purpose.

In using a barbed-wire fence for a line, merely see that the "line" is continuous; insulation does not matter, nor does the resistance of the iron wire.

WIRELESS STATION AT UNIVERSITY OF MICHIGAN

(*Continued from page 1246.*)

No switches are needed.

Fig. 5 gives some idea of the antenna. This is fastened to the top of a 150-foot brick stack. The spreader is 20 feet of 1½" steel conduit pipe.

The insulation is tarred hemp rope in the bridles and electrose 11" insulators in the wires. Four wires are used par

way and then six wires are used, this is a very peculiar construction. All wires are 7 strand No. 20 phosphor bronze. The "leads" leading into the instrument are two No. 4 very finely stranded copper cables. Plate glass "lead in" insulators are used. The ground is equivalent to No. 0000 finely stranded copper cable and bolted to the steel frame work of the building also a No. 0000 cable running out to a 6" water main.

When transmitting on full power the antenna is *blue* from end to end, and emits a tone that can be heard four or five blocks away. It requires about 25 amperes in the antenna circuit to produce this effect. Fig. 6 gives an idea how the wires are brought over the building and into the operating room. The + shows the operating room. The high end of the antenna is located about 350 feet back of the operating room, and the top of the chimney, to which antenna is fastened, cannot be seen from this view. (In a later issue I will publish an article on antennas in which I will describe the reason for beginning with six wires and ending up with four or two wires.)

ELECTRICAL MOUNTAINS TO PROVIDE ENERGY FOR THE WORLD?

It is reported that the Chilean Government, acting with those of Bolivia and Peru, have appointed a commission of scientists to investigate a strange light which is flashing from the Andes in Chile. The light is visible within a radius of 500 miles from the main ridges of the range and is believed to be electrical in origin. It emanates directly from the mountains themselves. The three governments are anxious to see whether the enormous energy which is manifested can be harnessed and be made a source of power to irrigate the deserts on the Pacific slopes of the Andes and tame the wilderness west of the Cordilleras.

A suggestion has been made that the light may not be electrical at all; that it may be emanations from gigantic beds of radio-active substances, perhaps radium itself, which become visible under certain atmospheric conditions. If this latter theory is correct the Chilean Cordilleras hold a hoard which will change the destinies of the world.

Dr. Pedro Santinez, one of the commission selected, writing of the extraordinary phenomenon, says:

"The light is ordinarily of a glistening appearance and has the shape of a bold curve. It appears to have fixed points of issue and changes only in the frequency of its discharge and in its extent. The most vivid flashes come from a very definite point, and the radiation sometimes reaches far above the zenith and away to sea. The extraordinary phenomenon can be seen with greatest ease when the sky is clear.

"The flashing begins late in Spring and lasts until early Winter. Toward the south then the light ceases almost altogether. But in northern and central Chile, in Peru and Bolivia the flashes are intermittent throughout the Winter.

"We owe all of our present knowledge of the light to a distinguished naturalist, who recently, during a journey through a valley of the main Cordillera, observed this phenomenon with exactness. One evening about 9 o'clock, while studying an unusual and frequent discharge, he was able to ascertain that its point of issue was an elevation of the Cordilleras along which he was roaming. Moving constantly around this peak was a band shaped like a segment of one or two degrees in height and somewhat similar to the zodiacal light in brightness.

"During the present season the light has glistened as usual, but with much greater strength, and especially above the discharge, into which the glistening has disappeared after a moderate interval. The naturalist believes that this flashing of the Andes is due to profuse electric discharges in certain districts of their Chilean section, and particularly among the greater peaks. The predominating popular view is that this light is a reflection of the molten lava in volcanic craters. Such a view is erroneous, however. It is not improbable that the number of the points at which these discharges occur changes; and it is possible, too, that during the great earthquake of August, 1906, discharges occurred along the whole crest, for, if we may accept authoritative statement, the sky everywhere in Central Chile then flashed with a

quivering 'fire,' such as was never seen either previously or thereafter.

"Observation leads to the conclusion that this seemingly radiance of the Andes is the result of a copious issue of electricity. How these discharges, which are noiseless and produce no sparks, may be designated at this day, is not quite clear.

"It is probable that in the Andes is a source of power such as the world has never known and which, if it can be harnessed, will be found capable of providing energy for the whole world."

CARRIER FOR SMALL MOTOR

The greatly increasing use of small motors in the home has given rise to the small-motor salesman. His work is to carry a motor from house to house and demonstrate what it will do and that it will run on electric light circuits. The illustration shows a convenient carrying strap invented and

adapted by a manufacturer for salesmen's use.

MRS. CHAMBERS

(*Continued from page* 1250.)

naval stations from north to south of the United States and from the Atlantic to the Pacific; and very distinctly.

Possibly the rest will not be so interesting, although I should like to mention that when we cut down our power for short range transmission, we also use a smaller antenna. This is composed of 6 wires, aluminum, No. 12 B & S, 60 feet long, and is suspended from one pole straight down. As most all readers will know, the antenna is a capacity, and the capacity depends on the size of the antenna, that is—on the number and size of wires used, the length of same, and the distance they are apart; and so when using full power for transmitting, we use the large antenna, and when using a small amount of power, we use the small antenna."

ELECTRIC POWER REPLACES MAN POWER IN HAWAII

Until recently the sugar crops of Hawaii were brought from the fields

on the backs of natives or ponies. American enterprise has, however, changed the order of things and up-to-date methods are coming into general use. The illustration shows an American made electric locomotive and train bringing in its first load of cane.

EARTH PLATE RESISTANCE

(*Continued from page* 1249.)

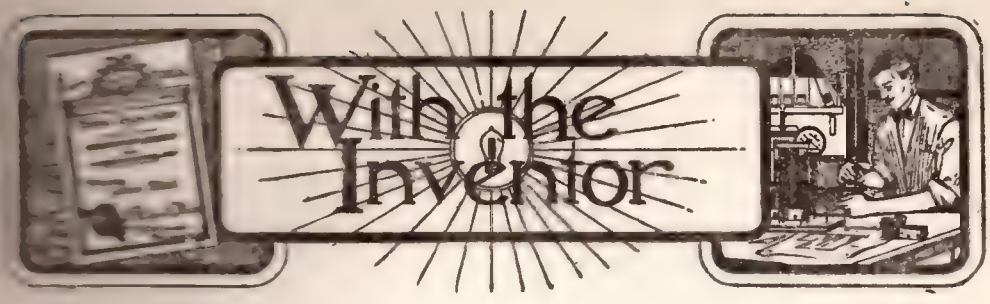
TABLE 2

Specific Resistance of Water and Soils.

Sea Water	100
Fresh Water	100,000
Damp Soil	10,000 to 100,000
Dry Soil	1,000,000 & +

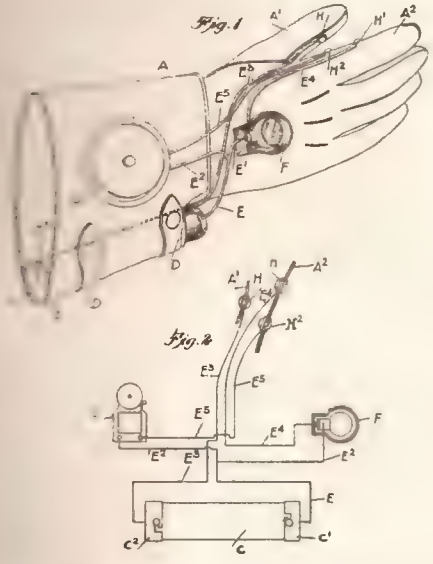
Electricity for pumping purposes is extensively used in the West.

Ozone is to be used to sterilize the drinking water at St. Petersburg.



CHARLES A. SCHINDLER, OF WEST [illegible], N. J., HAS BEEN GRANTED PATENT NO. 1,046,225, FOR SIGNALING DEVICE.

The present invention relates to a signaling device, and we showed a similar invention not long ago in *Modern Electrics*, which, however, differed from this one in that no battery was actually carried by the wearer. In the present invention a small battery, B, is located right in the glove as shown, and there are two circuits as shown.



By contacting A1 with H2, the bell signal device, G, which may be a bell or other loud audible signal, will sound. By contacting A1 with A2 the lamp, F, will light up.

It is apparent that such an invention will find good use for automobiles or persons driving carriages where it is required to give other vehicles either an audible or visible signal. Our illustration shows the device so clear that additional information is hardly needed.

FELIX GOTTSCHALK, OF NEW YORK, HAS BEEN GRANTED PATENT NO. [illegible] FOR A TELEPHONE TRANSMITTER.

This invention relates to a telephone transmitter, and consists of the use of a sound receiving diaphragm of rolled or tempered metal having an initial stress in combination with an improved form of water and air tight casing.

There is nothing fundamentally new in this invention except the points stated above and we quote herewith an extract from the patent:

"In the accompanying drawings Figure 1 is a front view of a transmitter embodying this invention, with portions broken away. Fig. 2 is a cross-sectional view through the transmitter, and with the terminal piece partly broken away. Fig. 3 is a detail of gasket used in this transmitter. Fig. 4 is a cross-sectional view through a modified form of casing. Fig. 5 is a plan view of Fig. 4, with parts removed.

Like figures of reference denote the same parts wherever they are shown.

1 is a casing, across the front of which is placed the sound receiving diaphragm 2, which is separated from the casing by suitable packing 3 of such thickness that the space between the diaphragm and casing is reduced to a

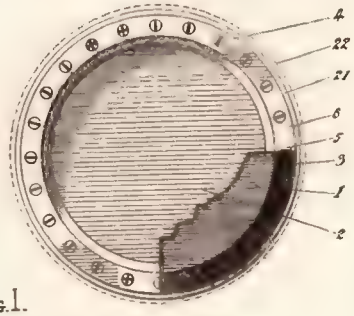
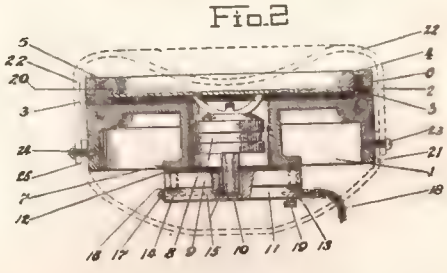


Fig. 1.

Fig. 2



minimum. The diaphragm used in an instrument of this type must be of metal and is preferably rolled like phosphor bronze or tempered like steel, so as to possess an initial inherent stress, thereby eliminating the neces-

sity of employing stretching means when the diaphragm is in place.

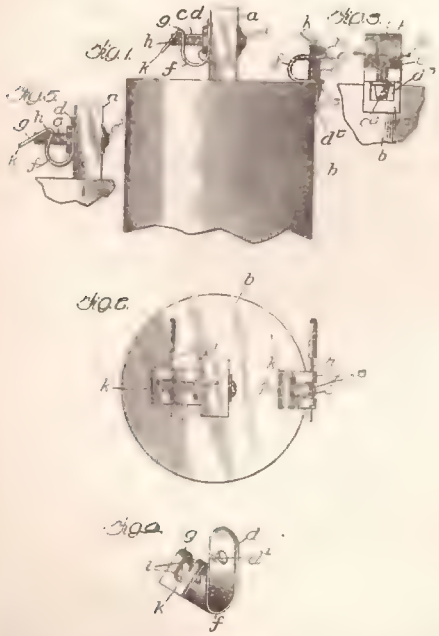
Heretofore metallic diaphragms for telephone transmitters have usually been constructed from ferro-type iron or aluminum, and in this construction required the use of damping springs, clamps or pins, either on the outside or inside of the diaphragm, thus preventing free vibration. I eliminate devices of this nature by my improved diaphragm, which, being firmly secured only at the periphery, is free to vibrate, like a drumhead.

To securely attach the diaphragm to the casing I employ a row of screws indicated at 4 and 5, which securely hold the clamp ring 6 on the diaphragm as shown, but, if desired, any suitable alternate method of clamping may be employed. For instance, with diaphragms of certain thicknesses it is desirable to bevel the edge of the casing 1 as shown in Fig. 2 and to slightly dish the diaphragm to conform to said bevel, and to then employ the ring with inwardly beveled edge as shown at 6, Fig. 2. The casing 1 has a rearwardly projecting flange 7, having an aperture 8 therein, in which is placed a cell 9 of any suitable type. The cell illustrated in the drawing is of a well known form, having its insulated front electrode toward the diaphragm and its frame electrode toward the rear of the cell, the stem 10 being a part of the latter."

All the other features of the patent are easily understood by studying the illustration.

THOMAS G. GRIER AND HENRY M. FISK, OF CHICAGO, ILL., HAVE BEEN GRANTED PATENT NO. 1,045,280, FOR A SPRING CONNECTOR.

This is another spring binding post, of



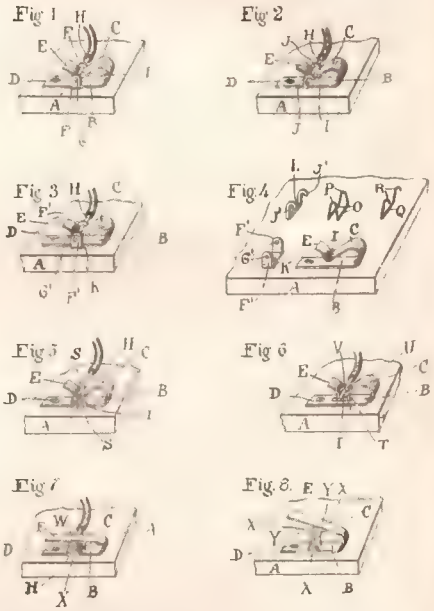
which so many have cropped up lately, this one having the merit of exceeding simplicity. There is hardly much description necessary, and by referring to Figure 1 it will be seen that by pressing on the spring part, *k*, of the post the part *g*, will move over the threads, *c*, and the wire, *h*, will thus be secured.

We do not like this arrangement very much, for if the part, *g*, does not press down on the wire with sufficient force there will be a loose contact. There is no other objection to the post, except that it is too cheap looking and its sharp corners and points will naturally make a limited market for it.

However, on articles such as dry cells, where the smallest fraction of a cent means a great saving, the device is all right.

JOHN SCHADE, JR., OF NEW YORK, N. Y., HAS BEEN GRANTED PATENT NO. 1,049,609, FOR SPRING FASTENING DEVICE.

This is the patent on the now famous spring binding post, and this article has



proved more successful than perhaps any other similar device.

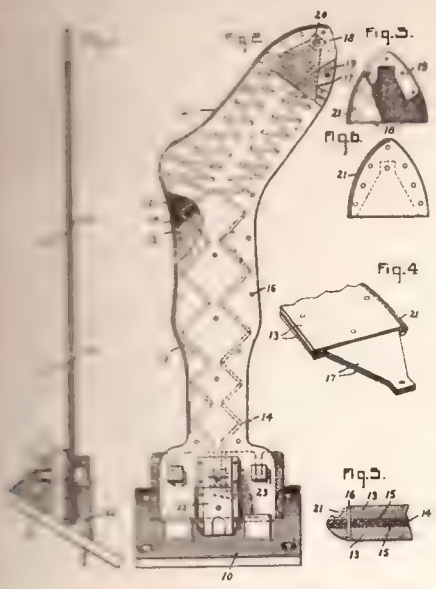
The largest battery company in the country has adopted this binding post for its batteries, and, although it is by no means a perfect binding post, it has many good points, the best one probably being its great cheapness.

As will be seen, the article is made of one piece of metal, bent in suitable form, and it will be observed that a great many forms are covered by this patent, also by a former patent. The only trouble with this binding post is that it is rather unsightly, and that it has sharp corners that cut the fingers easily; aside from this, it is probably an ideal binding post, considering its cost and considering the service it renders.

PATENT NO. 1,046,514, FOR ELECTRICALLY HEATED HOSIERY FORM, HAS BEEN GRANTED TO FREDERICK M. VOGEL, OF PITTSFIELD, MASS.

This queer invention, which, of course, was

[illegible] devised for factory use, relates to an electrically heated form for drying hosiery and the like, and has for its object a provision which will effectually dry the hose and give them a neat as well as creased appearance and at the same time reduce the cost of operation. The invention itself is self-apparent and not much explanation is necessary.



A zig-zagged resistance conductor, 14, runs throughout the length of the form, which may be of any suitable material. This form is heated by an electric current, and several tips as shown in Figs. 3 and 6 may be substituted, thereby accommodating several sizes of nose. The illustration shows this clearly.

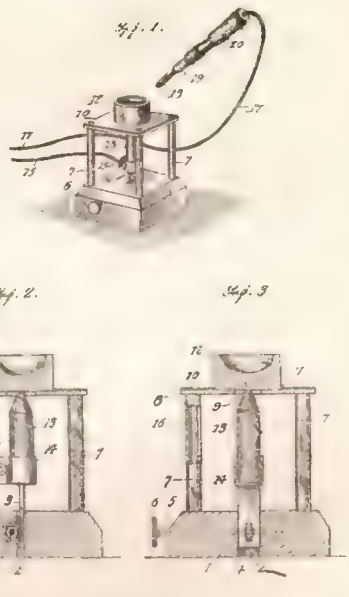
PATENT NO. 1,049,043, FOR ELECTRICAL MELTING AND SOLDERING APPARATUS, HAS BEEN GRANTED TO WILLIE M. BOWLES AND CHARLEY O. ALLEN, OF SHAWNEE, OKLA.

The invention relates to improvements in electrical melting and soldering apparatus, and the illustrations show the idea clearly. The main object of the invention is to provide an electrical heating device for melting and soldering metals with great facility and with a minimum expenditure of heat. Another object of the invention is to provide a portable device, which can be readily connected to any electrical circuit. We quote the patent extract herewith:

"In carrying out our invention, we provide a base, 1, made of any suitable non-conducting material. In the drawing the base is made square, but it may be made in any other suitable shape. The base is provided with a vertical slot, 2, in which is disposed a slidable support, 3, arranged to be engaged by a ratchet wheel, 4, on a shaft, 5, which terminates in a hand wheel, 6. Upon the top of the base, 1, is a series of supports, 7. In the present instance these supports are shown as hollow glass rods, carrying at their tops a carbon plate, 8, having an opening, 9, in its center. Surmounting the carbon plate is a metal plate, 10, having an opening, 11, adapted to receive a crucible, 12. The slidable member, 3, carries a carbon stick, 13, which is arranged to be held in a socket, 14, carried by the member, 3. A flexible conductor, 15, is secured to the socket, 14, by means of the binding post 15a. The plates, 10 and 8, may be secured to the top of the support, 7, by means of bolts, 16, which pass through the hollow rods and are secured at their ends in the base, 1.

"From the foregoing description of the various parts of the device, the operation thereof may be readily understood.

"In the illustrations, a crucible, 12, is shown. In using the crucible, the piece of metal to be melted may be placed therein and the carbon stick, 13, may be brought up into contact with the bottom of the crucible by turning the thumb wheel, 6. The crucible, therefore, forms part of the electrical circuit. The other part of the electrical circuit is formed by means of a flexible wire or conductor, 17 (see Fig. 1), which is attached to a carbon pencil, 18, held in the metallic socket, 19, the latter being inserted in an insulating handle, 20. When the metal is placed within the crucible the current is turned on in the wires, 15 and 17, by means of an appropriate switch, and by touching the metal the circuit is established through wire, 15, binding post, 15a, socket, 14, carbon stick, 13, crucible, 12, through the metal to be melted or soldered, carbon stick, 18, and wire, 17. The heat is generated where it is needed most—*i. e.*, between the carbon stick, 18, and the metal to be melted, and upon that part of the crucible or receptacle upon which the metal rests. The



plate, 10, serves to keep the crucible in its central position over the movable carbon stick, 13.

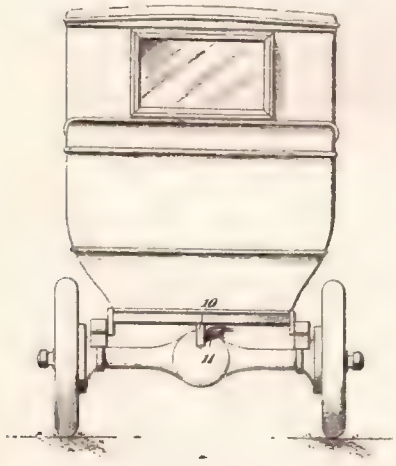
"Instead of using the crucible, I may use a comparatively thin carbon plate, 21. This may be placed upon the plate, 10, and the

carbon stick may be brought up until just in contact with it. By manipulating the hand wheel, 6, an arc may be produced which is sufficiently intense to heat the carbon plate, and, therefore, to melt the solder when an article is placed on it."

DUANE DANN, OF CHICAGO, ILLINOIS, HAS BEEN GRANTED PATENT NO. 1,050,812, FOR AN INDICATOR FOR AUTOMOBILES.

This invention relates to an indicator for automobiles and other vehicles, to show in which direction a vehicle is turning. The invention also has for an object to provide in connection with the indicator, an electric

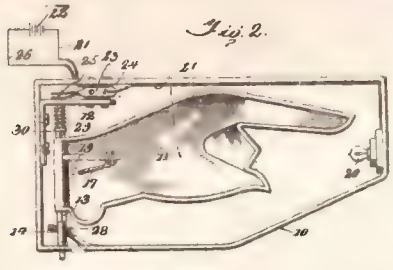
Fig. 1



lamp, the circuit of which is controlled by the movement of the indicator.

The illustration describes the invention

Fig. 2.



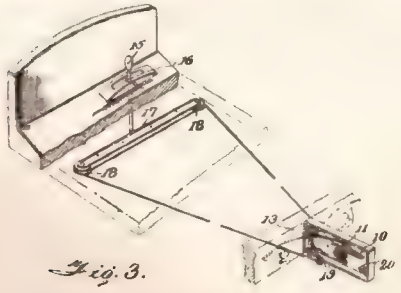


Fig. 3.

better than words. It will be seen that it is a device which has a hand which may be either pointed to the right or to the left by means of the lever, 15, in Fig. 3. This moves the cord, 17, which in turn moves the hand back and forth. The electric circuit

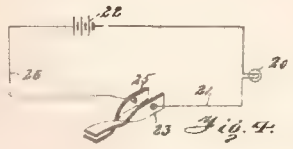
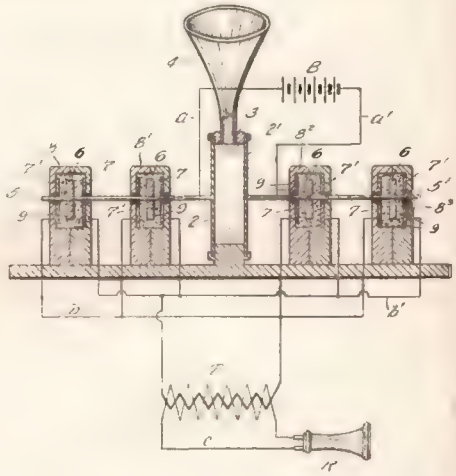



Fig. 4.

is connected to the frame, as shown in Fig. 2, and the device itself, on an automobile, is shown in Fig 1. It is quite a good idea, and simple enough, although perhaps the throwing of the hand to the right or left might easily be accomplished by means of an electromagnetic device.

PATENT NO. 1,049,253, FOR A SOUND TRANSMITTING APPARATUS, HAS BEEN GRANTED TO CHARLES W. McGONIGLE, OF ALGONA, WASHINGTON.

The present invention relates to a sound transmitting apparatus which may be used with an ordinary telephone system, and par-



ticularly for wireless telephony, where a transmitter using a lot of current is an absolute necessity.

We quote the language of the inventor as follows:

"The invention is illustrated by the accompanying drawing, which shows in section a sound transmitter with the electrical circuits therefor shown diagrammatically.

The reference numerals 2 and 2' designate two diaphragms secured about their peripheries to the ends of a hollow support, 3 therefor. Communicating with the space within said support is a horn, 4. Attached to the respective diaphragms and extending axially therefrom are metallic rods, 5 and 5', which are connected by wires, *a* and *a'* with a source of direct current electric supply, as indicated at B. Secured to said rods are disks, 6, serving as electrodes for the circuit members comprised of the respective

...screws and rods. Associated with each of said rods are stationary metal plates, 7 and 7′, which serve as electrodes for circuit wires, *b* and *b′*, respectively. The latter are connected in parallel with a telephone receiver, R, or an equivalent, and desirably through the instrumentality of a transformer or an induction coil, T, having a primary winding of relatively low resistance. The plates, 7 and 7′, are disposed in spaced relations at opposite sides of the respective disks, and are inclosed in receptacles, such as 8, 8′, 8² and 8³. Granules of carbon, or an equivalent material, indicated by 9, are provided between the disks and the various associated plates.

In operation, the undulatory movements of the diaphragms generated by sound waves cause the electrodes, 6, to be moved toward or away from the electrodes, 7 and 7′, resulting in the granular medium at opposite sides of the movable electrodes affording varying amounts of resistance to the flow of electric currents or impulses from the normally incomplete local circuit, a a′, to the circuit connections, *b*, *b′*, of the electrodes, 7 and 7′. The series of electrical impulses thus transmitted through the electrodes are of an alternating character, and are thus applied through the medium of the induction coils, T, to the circuit wires of the receiver, R. More particularly, when the diaphragms are pressed outwardly the electrodes, 6, which are connected therewith, are caused to approach the electrodes, 7′, whereupon the resistance afforded by the medium, 9, is lessened between the referred to electrodes with a proportional increase in the resistance afforded by the said medium with respect to electrodes, 6 and 7. Consequently, as the movable electrodes, 6, are alternately brought into proximity of the stationary electrodes, it is evident that alternating currents are produced in the circuit wires, *b*, *b′*. When the electrodes, 6, are brought into neutral positions with respect to the other electrodes, as would be the condition when the diaphragms are uninfluenced by sound waves, the wires, *b*, *b′*, would be short-circuited between the various movable electrodes and all of the others, and hence be ineffective at the receiver.

The number of groups of transmitting elements composed of an electrode, 6, interposed between the granular matter and the adjacent fixed electrodes may be varied to suit the service or according to the amperage or current supplied.

By such devices a relatively strong current, as 600 volts, for example, may be employed, and that, too, from a circuit which is utilized for supplying power directly to electric motors and without injuring the certainty and definition of the sounds transmitted by the instrument."

This is a very unique device, and should certainly prove of great value if the motion of the diaphragms, 2 and 2′, can be readily transmitted to the last microphone, but we fear there will be quite some loss due to friction, but this perhaps can be overcome by having ball bearings.

PATENT NO. 1,048,117, HAS BEEN GRANTED TO ROGER F. WILLIAMS, OF BUFFALO, N. Y., FOR DETECTOR FOR WIRELESS TELEGRAPHY AND TELEPHONY.

This invention presents a new detector for wireless telegraphy and telephony, and the inventor makes the following claims:

"When operating a wireless telegraph or telephone apparatus, the terminals of the detector are usually separated and the receivers are short-circuited or cut-out, so as to prevent burning out or injury of the detectors and receivers, and also preventing shocking the person who may be listening at the time a message is being sent.

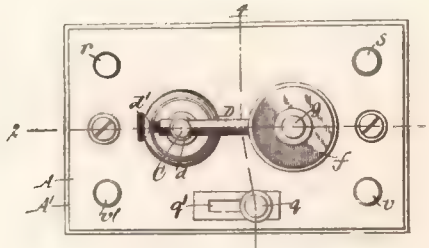


Fig 1

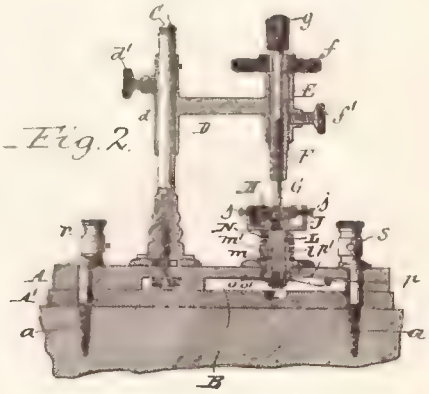


Fig. 2.

The detectors for wireless telegraphy or telephony heretofore in use have usually been so constructed that whenever the terminals were separated preparatory to sending a message the normal adjustment of the terminals relatively to each other was disturbed and required readjustment after each sending operation to produce the best results, thereby causing interruption and delay in the transmission of messages. Furthermore, in these prior detectors the means for moving the detector terminals and the means for cutting the receivers into or out of circuit were entirely independent from each other and necessitated separate operations for placing the same into one or another relation to the rest of the apparatus, thereby necessitating greater care in the proper manipulation of the apparatus.

The object of this invention is the production of simple, convenient and efficient

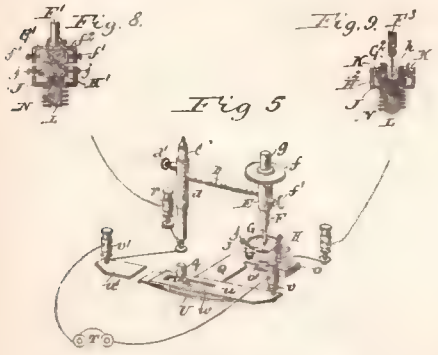
means, whereby the detector terminals may be quickly separated and the receivers cut out preparatory to sending a message, and the terminals of the detector may be again brought together and the receivers again placed in operation after sending a message—preparatory to receiving a message without causing any disturbance in the adjustment of the detector terminals, thereby avoiding interruption and delay in wireless telegraphic or telephonic communication.

My invention has the further object to so construct the detector that the operation of moving the detector terminals toward and from each other and rendering the receivers operative or inoperative is effected simultaneously and by the same movement of the operator."

In the illustrations, Fig. 1 shows the top view; Fig. 2, a partial cross section, and Fig. 5 shows the complete instrument assembled and the connection with same.

There is nothing absolutely new about this invention on which five claims have been allowed, but it is a well-conceived idea and the adjustments are very fine.

As will be seen in Fig. 8 and Fig. 9, the same detector can be used either for a single mineral detector or for the kind of detector using two or more minerals, also as an electrolytic detector.



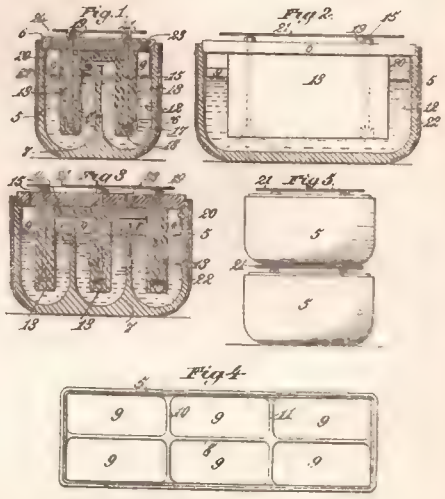
In Fig. 5 is shown the arrangement by means of which the detector cup can be moved back and forth easily.

We are quite sure that our readers will be interested in this invention.

GEORGE S. ENGLE, OF PROVIDENCE, R. I., HAS BEEN GRANTED PATENT NO. 1,049,347, FOR A PRIMARY BATTERY.

This invention relates to a primary battery, and we only illustrate it to show how not to invent a battery. The idea of this battery is that the container acts as a positive element (negative pole), which in every battery so far discovered is consumed as the battery generates current. In the present instance the container, 7, is made of zinc, which is a very bad arrangement, as, sooner or later, partition, 8, will be eaten away, while the heavier portions, as shown at 7, near the bottom, will be quite heavy long after the walls, 5, have been eaten through. This gives rise to an enormous waste of zinc, which is hardly required or necessary, as an equally good battery can be made by using ordinary zinc plates, which would use up the zinc down to the last particle. The parts shown under 13 are carbons bolted to the cover.

The battery, electrically considered, does



not show anything new, using the same old elements with the same old electrolyte.

PATENT NO. 1,049,333, FOR PRIMARY BATTERY, HAS BEEN GRANTED TO EDWARD C. BRICE, OF MANSFIELD, ARKANSAS.

This invention relates to another primary battery, and more particularly the inventor proposes to produce a battery of the kind in which polarization is avoided or reduced to a minimum.

The battery is supposed to give a large output of current at a good voltage, which may be maintained for a long time without the necessity of refilling the battery or of giving it any attention.

This is quite an interesting patent, and seems to show some distinct improvements, and we, therefore, are much pleased to give a copy of the patent in full, quoting the language of the inventor. We call particular attention to the new electrolyte which the inventor uses, which is, no doubt, of great interest to our readers:

"While the construction of my battery may be varied within wide limits and the materials employed may be changed or varied considerably, I describe one representative form of the invention in order that its principle of operation may be readily understood.

Reference is made to the accompanying drawing forming a part of this specification, and in which like letters indicate like parts, the figure being a substantially central, vertical section through my improved battery, in one of its simplest forms.

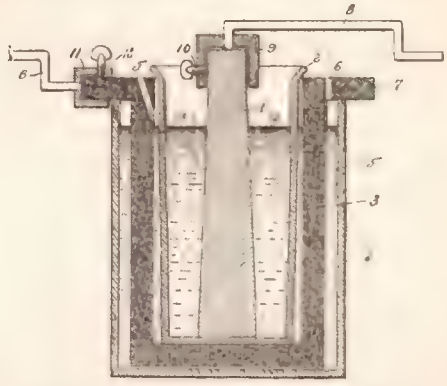
The anode, which in this instance is made of amalgamated zinc, is shown at 1, and has a substantially frusto-conical form. A porous cup, 2, which may be of the usual or any desired pattern, is slightly flared at its

substantially concentric to the anode. The porous cup, which is saturated with a depolarizing fluid hereinafter described, is located within a cup, 3, of porous carbon. This carbon cup is mounted within a containing vessel, 4, which may be of glass or other material suitable for the purpose of a containing vessel. The carbon cup, 3, is provided with slots, 5, inclined obliquely inward, and employed for the purpose of introducing the depolarizing fluid from time to time as needed. The carbon cup is the cathode of the battery. It is provided with an annular flange, 7, integral with it; and through this flange extend holes, 6, which are used for the purpose of introducing a liquid, forming a part of a battery fluid as herein described.

A connector is shown at 8, and is simply a conductor used for connecting an anode of one cup with the cathode of another cup, or to a terminal. The connector is mounted upon a clamp, 9, which is provided with a set screw, 10, for gripping the upper end of the anode. Each connector, 8, is further provided with a clamp, 11, carrying a set screw, 12, and used for gripping the annular flange, 7, of the carbon cup. The connections being old, need not be further described. Within the carbon cup, 3, is a body of liquid, 13, made by mixing together nitric acid and sodium chlorid (common salt) in the following proportions: 3640 grams of nitric acid of 36 to 36.1 degrees Baumé and 640 grams of sodium chlorid. The sodium chlorid thus constitutes approximately 12½ per cent. of the solution and the nitric acid constitutes about 87½ per cent. of the same.

The sodium chlorid and a small portion of the nitric acid react upon each other and form sodium nitrate and hydrochloric acid, so that the resulting liquid is a mixture of sodium chlorid, sodium nitrate, hydrochloric acid and free nitric acid. This liquid, as a whole, is a depolarizing solution, and absorbs gases as generated. The porous cup, 2, is thoroughly saturated with a quantity of the depolarizing solution, and is then pressed downwardly into the body of depolarizing solution contained within the carbon cup, so that the level of the liquid rises nearly to the top of the carbon cup. A solution of strong brine, in the proportion of 300 grams of pure water, such as rain water, to 360 grams of sodium chlorid, is next poured into the porous cup, 2. The sodium chlorid thus constitutes about 19½ per cent. by weight of the solution. The brine thus formed, and contained within the porous cup, is the electrolyte proper, and is shown at 14. The carbon cup, the porous cup and the anode, being treated and assembled as above described, are as a unit let down into the containing vessel, 14, in which is a body of liquid, 15, the latter being preferably either brine of the kind above mentioned, or pure water, as desired. The battery is now ready for use.

If pure rain water is used in the outer containing vessel, it is soon permeated with the liquid contained within the carbon cup for the reason that the carbon cup, being porous, allows the liquid contained within it to soak through its wall and to become diffused through the rain water. Owing to



this fact, and to the fact that chemical changes are produced within the liquid contained within the outer containing vessel and surrounding the carbon cup, the chemical composition of the liquid within the outer containing vessel soon undergoes changes.

I find from experience that if brine of the kind above mentioned be employed at the start as the liquid contained by the outer containing vessel the efficiency of the battery is much greater than if other liquids be employed in this relation. I also find from experience that pure rain water used in the relation stated is very good and that after the battery has been in action for a little time its efficiency increases—owing apparently to the changes brought about in the character of the liquid in question, under action of the electric current.

With the battery above described there is little or no polarization, and the current produced is very strong. The battery may be neglected for comparatively long periods of time without substantial impairment of its efficiency. The parts are readily accessible for the purpose of cleaning or renewing. The battery is cheaply constructed and may be operated at a small cost."

The particular compound used in this primary battery is made the subject matter of the co-pending application filed May 27, 1911, Serial Number 629,826.

ARCHIE FREDERICK COLLINS, OF NEWARK, N. J., HAS BEEN GRANTED PATENT NO. 1,050,777, FOR A PHONOGRAPHIC WIRELESS TELEPHONE.

This curious invention of Mr. Collins' relates to an improvement in phonographic apparatus, in which a coin dropped in a slot sets in operation a phonograph provided with a record and having suitable ear pieces, so that one may hear a song or speech by the payment of a coin; and the objects of the improvements are, first, to provide a new and novel form of amusement in such a slot phonograph; and, second, to construct a wireless telephone adapted for amusement purposes.

The fundamental idea of the invention is

to provide an amusement device, and may be classed with that line of slot machine apparatus which one finds all over the country now. This invention will hardly prove

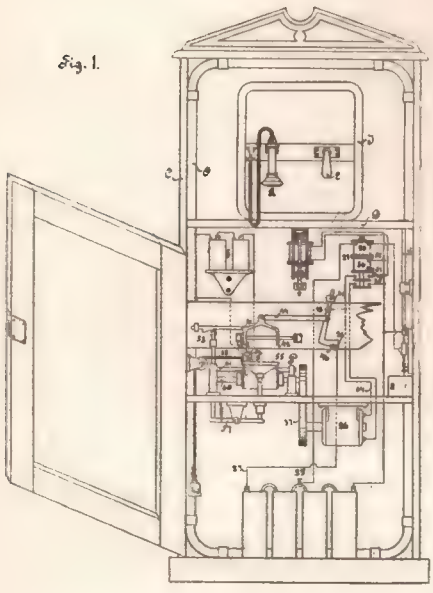


Fig. 1.

a world-mover, inasmuch as there is nothing contained in it that fills an actual want or even provides an unusual amusement feature.

It will be seen from the few illustrations that Mr. Collins uses a phonograph, shown

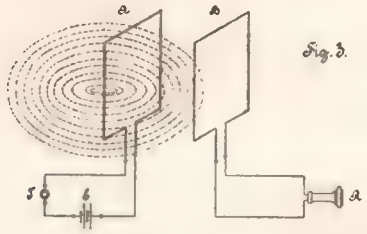


Fig. 3.

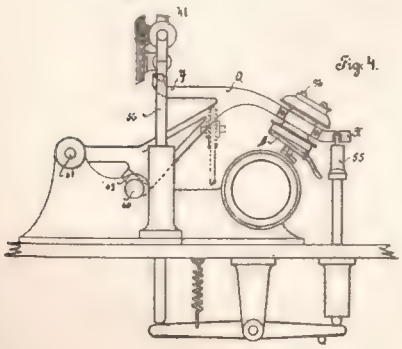


Fig. 4.

at 55, which is better shown in Fig. 4, and this phonograph speaks into a transmitter, N, which operates a small induction coil, thereby creating a small wireless telephone of the inductive kind, as shown in Fig. 3.

By referring to Fig. 1, it will be seen that after the person has droped a coin in the machine, the phonograph will start operating and the person is supposed to take the frame, J, and walk about to some distance and still be able to hear the phonographic speech, although no wires are connected with the main machine.

Of course, there is nothing fundamentally new in this invention, and every one of our readers has known for years how to build the inductive wireless telephone which Mr. Collins uses. The only new feature is the combination of the different apparatus. We also doubt that the outfit as described by Mr. Collins is "fool-proof," and that it will work at all times.

TOBIAS HERTZ, OF NEW YORK, N. Y., HAS BEEN GRANTED PATENT NO. 1,051,370, FOR A NOVELTY CANE OR UMBRELLA.

There are few articles in which a flashlight or the equivalent of same has not been introduced. We have now electric flashlight

Fig. 1.

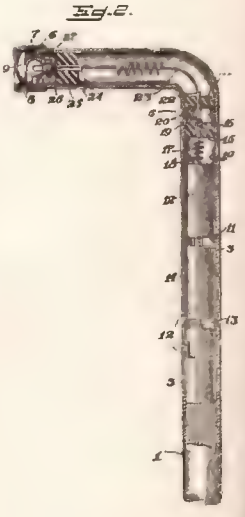


Fig. 2.

memo pads, electric flashlight egg testers, electric flashlight pencils, imitation revolvers with the flashlight concealed, imitation watches containing flashlights, electrically lighted coat buttons, scarf pins, etc, and now comes the electrically lighted cane and umbrella, shown in the present invention.

It will be seen that by pressing the button the flashlight, 9, lights up, being supplied with current by means of the battery, 12. The illustrations show the invention clearly, so that hardly anything more need be said in explanation of the device.

Concerning Experimenters

By Philip E. Edelman

[illegible] cheapened the art? A certain editor recently gave a good part of a column to the idea that the woods were full of irresponsible wireless amateurs who set up their crackling towers, causing anarchy of the air, etc. If you ask the average person about wireless telegraphy he is pretty sure to think about blue sky wireless stocks or amateurs bothering the Government, before the wonders of the art occur to him. Some will even smile when wireless is mentioned.

Wireless apparatus is more than a toy. Even those who set up an outfit for such a purpose alone soon realize this; the less interested ones abandon their apparatus, while the real experimenters continually try to improve their stations, try new experiments, read up every available word on the subject, and start out to master the details. It is assumed that the readers are all of the latter type, and the following notes are given for their benefit. They are taken from the experiences of other experimenters and should clear up a few doubtful points.

Why You Experiment

Few stop to consider why they experiment. They just do it. The reason is generally a secondary consideration and may be stated as amusement, self improvement, or both.

Records

Probably 1 per cent. of the readers keep records. It is not to be expected that the amateur experimenter will keep elaborate notes, but it is worth while to jot down diagrams, notes, or even messages for reference, and in a shape that the maker can understand any time in the future. It is good practice, if nothing else, and should go with the other features of experimenting. It is a mistake to copy pages of matter from magazines and books, or to clip illustrations from printed matter. The better way is to make a note of where the matter may be found and what it covers.

System

The average experimenter operates at less than 50 per cent. efficiency. He would not be satisfied if his transformer did not do better than this, but when it comes to himself, it is a different matter. A good part of the fascination, to be sure, lies in the uncertainty and happy-go-lucky methods, but this does not prove that precise methods are not more fascinating. Some, for instance, will start a transformer by buying a supply of wire, and then filling in the other parts by guesswork, to match. Others will accumulate a fine collection of apparatus without understanding why it works or even how to use it. Apparatus represents an investment, either of time or money or both, and system demands that the owner gets at least his *interest* out of it. There is a tendency on the part of some to allow the apparatus to accumulate in disorder, until, as one man explained to a group of young men, "We had to take a shovel to clean the room out." A good plan is to have a clean up once in a while, and then start out like new again.

In nearly every case the apparatus that is taken care of will give better results than the neglected apparatus. Dust is one of the commonest signs of negligence. A cloth cover should be provided for apparatus that is used only at intervals. One experimenter made a swinging cover, like a box cover, for his table. When through, he moved the cover over the apparatus, with the assurance that it would be in good condition the next time that it was to be used.

Some experimenters will, on the other hand, spend nearly all their time making elaborate divisions, shelves, and files for their apparatus and tools, and lose sight of the main object of their efforts. It is best to strike a happy medium in this as well as other features.

Apparatus

Whether the apparatus is purchased or made is perhaps unimportant. The careful experimenter sees to it that he gets his money's worth in either case. It is surprising to note the wide variety and reasonable prices of the ap-

paratus available. It is well known that many pieces can be had for less than the cost of individual manufacture. At the same time, there is a real satisfaction in making the thing yourself, and seeing it through to the end. The fellow who has to make the best of a scant supply of money, making apparatus from odds and ends, getting working results from discarded materials, and who gets along with the home made makeshifts, may have a strong desire for the regular instruments, but at the same time, he gains much that can be obtained in no other way. On the other hand, the fellow with the accurate standard instruments has an advantage which is not fully realized and overlooks the opportunity for exact experiments. The greatest satisfaction comes only when the apparatus is fully understood and utilized to the best advantage. The beginner may think it great to receive his first local message, but the same fellow, a little later, gets more satisfaction when he coaxes a distant message into the same apparatus by his own skill.

Correspondence, Etc.

Never be ashamed to ask a question, however elementary it may be. The writer recently overheard the following conversation:

"I want a 125 ampere switch."

"We have in stock (pause, as the clerk wonders how such a young fellow can own a big power plant) . What size motor did you say that you wanted it for?"

The customer innocently replied, "One-half horsepower for alternating current, and the clerk, suppressing his thoughts, produced a six ampere switch.

Of course this would not happen to any of the readers, but it illustrates the point. If a friend tells you that a certain detector operates on so many ergs per dot, ask him about the point you do not understand or look it up yourself. When you read that the logarithmic decrement per complete oscillation is a certain value, don't be satisfied until you know why and all about it. Nearly everyone is willing to answer an intelligent question, or at least to tell you how you can find out for yourself.

In correspondence the following faults should be avoided:

Writing in pencil, especially hard drawing lead pencils.

Forgetting name or date or address.

Telling irrelevant matter.

Omitting the essential data, as purpose, object, uses, etc.

Errors in form, grammar, spelling, etc. (Yes, they are common.)

Forgetting to enclose stamps, enclosures mentioned in the letter, to use the right address, etc.

Many experimenters are very careless in their ordinary correspondence, and should realize that a note scrawled on the back of a postcard is not the proper method of asking information, for catalogues, etc. Indeed, many concerns will not pay attention to any cards. The best plan is to enclose a stamped and addressed envelope.

Experimenting, then, is a privilege, and should be carried on to the best advantage. Only a few points have been mentioned in these paragraphs and they are obvious enough. If, indeed, amateur experimenters have exposed the simplicity of wireless signaling and have made the art a common possession, they have also aided its advancement, even if only in a small way. There is nothing undignified about experimenting, and it may be safely said that the amateur experimenters are among the best class of young men to be found to-day.

A MUSIC MACHINE FOR COMPOSERS

"Everything is done by machinery nowadays" has been a common expression for a decade or more, and every year brings it nearer the truth. One of the latest inventions is a device for writing music by machinery.

A Swedish inventor named Nystrom invented the apparatus, which may be used in connection with any keyboard, either piano or organ. It is operated by means of electricity, and when a piece of music is played in the ordinary way, this device, called a melograph, records the sounds on a chemically prepared ribbon which has been treated with a preparation of wax to allow the impressions for each tone.

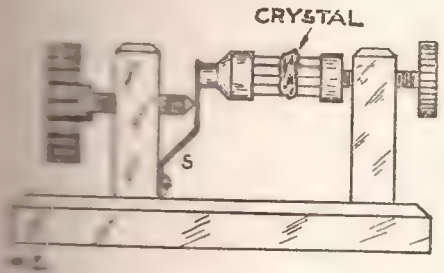
After the music has been played the ribbon may be removed and read, just as one would read shorthand notes or the telegraph code. And in reading it the

may be made, when ... there is the music, actually "writ-

... of the greatest values of this in... is to composers. A composer ... finally strike exactly what he wants ... play it as though inspired. Under ... method he had either to mem... it by playing it over and over and ... writing it, or jot it down note by ... With the aid of this invention he ... play his composition, remove the ..., and there it is, ready to copy into ... form. Another feature of this ... is that the ribbon may be placed ... specially constructed player and ... music rolls are put ... mechanical piano and played.

CORRECT USE OF CARBORUNDUM CRYSTALS

... as used by owners of ... stations is a very much abused ... in that it is rarely used in the ... to secure the best results. It ... generally clamped between two ... points or laid on a flat surface



... a point sticking down into it and ... enough battery used to burn out ... respectable pair of wireless ... As carborundum has a very ... resistance, a good electrical ... must be secured at two points, ... the ends of the crystal, and ... is done by commercial companies ... in the drawing. Into two brass ... are soldered five needle points, the ... very similar to those used as ... needles and the crystal is ... between these contacts. This ... five different contacts with the ... at both ends and with the ... adjustment, shown at S, makes ... pressure light or heavy as the case ... With good crystals a small ... is used and good crystals are usually greyish in color and rather close grained, with here and there a place that looks like it was fused or melted. Best results are obtained by using small crystals. The object of having good contact with the crystal is evident when the statement is made that a one-half inch cube of carborundum has a resistance of 7,500 ohms.—*Stanley E. Hyde.*

MAGNETIC INTERRUPTERS ON LIGHTING CIRCUITS

Electromagnetic interrupters of the ordinary kind can be built only for a tension of a few volts. In order to operate them from a network at from 110 volts to 440 volts the connections shown in Fig. 1 may be used, in which *u* is the interrupter, *w* a high series re-

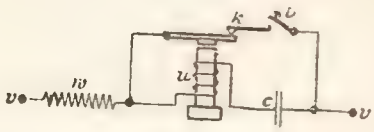


FIG. 1

sistance and *c* a condenser of about 1 mfd capacity. The contact *k* is first closed, while the switch *t* is open so that the condenser *c* is charged from the supply voltage *vv*. When the switch *t* is closed the condenser discharges through the magnet coil in form of a damped oscillation. The armature is attracted and the contact *k* is opened so that the condenser is charged again, and so on. The contact *k* interrupts only the small non-inductive current

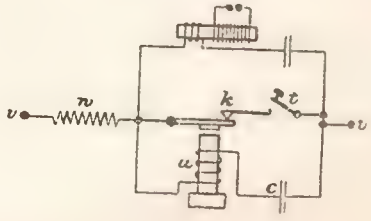


FIG. 2

which passes through the series resistance, while the condenser helps to suppress the formation of sparks. For the operation of induction coils the arrangement shown in Fig. 2 may be used, the induction coil, together with a special condenser, being connected in parallel with the interrupter.—*Elek. Zeit.*

SMALL ELECTRIC MEASURING INSTRUMENTS

A good measuring instrument is seldom to be found in an amateur laboratory, the reason being, in most cases, the high prices charged for such apparatus. In this article the writer will describe the instruments he has handled and used so as to give the reader an idea of their construction and to enable the experimenter to purchase the proper instrument for this purpose.

The average experimenter has evidently tried to construct his own volt and ammeters, but has failed to make them work because after making his instrument it either was not sensitive enough or too sensitive. Also he may not have had good material for bearings, the means for calibrating it or the means for calculating the number of turns of wire for the coil and the construction of the moving element. The writer has spent

FIG. 1

FIG. 2

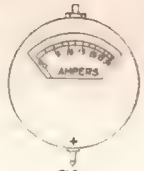


FIG. 3

much time and money in trying to construct such instruments but so far has not succeeded in making anything that is of any account either practically or theoretically.

The small pocket meters put up by various firms for battery testing are very useful for the experimenter as he can use them in many experiments and also in practical work. These meters are put up in about three different ways, that is, three different principles for their construction are used.

One style of meter for battery testing works on the principle whereby a solenoid draws into its hollow part a soft iron vane so shaped as to conform with the size and shape of the solenoid and cause greatest magnetic attraction. The index, or pointer, is attached to that vane. A spiral phosphor bronze spring brings the pointer back to zero and makes the instrument dead beat. Figure 1 shows such an instrument.

The second style of meter (mostly used and made in France), operates on the principle of repulsion. A fixed piece of soft iron and a moving vane of the same material are mounted in the same field coil and near each other so the exciting current magnetizes both with alike poles causing them to repel more or less according to the strength of the current flowing. The moving vane carries the pointer. Such instruments are reliable, especially when they are spring controlled (which they are in the small instruments), but they are also constructed for the pointer to be brought back to zero by gravity, and when so made must be mounted on a wall and fastened permanently. They are called magnetic vane instruments. One type of such instrument is shown in Figure 2.

Figure 3 shows a type of instrument depending upon a permanent magnet and an electromagnet for indication. The permanent magnet makes the instrument dead beat and holds the pointer at zero. It also holds a little vane (soft iron) at a certain position and the current to be measured energizes the electromagnet mounted right over the little vane, causing the vane to swing up toward the electromagnet thereby bringing the index across a scale.

The first two instruments have the following advantages over the third: (1) a reading can be obtained from either pole of the battery, (2) and not being magnet controlled, they can be made much smaller and lighter. Permanent magnet instruments read higher when the magnets are weakened, which can be caused by dropping and jarring the instruments.

The above described low-reading instruments which are reliable and accurate enough for the experimenter to use can be procured at almost any electrical supply house at moderate prices, and with ordinary care will last a long time. They come in different ranges and various sizes and the experimenter will do well to purchase one which will suit his needs instead of trying to construct one, thereby saving time and money.—*Jacob Laudau.*

Ontario farmers are adopting electricity for power and light.

THE WIRELESS BLUE BOOK

As stated in the article on page 1056 of the January number, entitled "Revision of all Wireless Calls," the Department of Commerce and Labor will assign through the various radio inspectors the call letters of all amateur radio stations. For this reason it will be impossible for us to publish the new edition of the Blue Book at as early a date as we originally intended, and it is therefore necessary for us to postpone the publication of this book until such time as the majority of the amateur stations have been examined by the radio inspectors and their call letters assigned. It will be necessary for us to get this information from the government and for this reason we cannot, at the present time announce the date of publication.

GOOD USE FOR WIRELESS

That wireless telegraphy is to be a powerful factor in the civilization of the world and in the opening up of the dark places still left untrodden, is proved by the fact that the commission appointed by the federal government to establish wireless stations in the forests of the Amazon is now actively engaged in the work entrusted to it. The commission has just penetrated through the 200 kilometers of virgin forest, the rivers being so low that canoes could only move with difficulty upstream. A station has been established at Senna Madureira, while the Alto Jurua service and the subsidiary stations have been opened to traffic. When the work of the commission is completed the forests of the Amazon will no longer be cut off from all human touch.

SAYS MARCONI TRIED TO GET CONTROL OF POULSEN PATENTS

That the Marconi company had sought to obtain control of the Poulsen patents in America and had been refused, and that later Mr. Carl Phillip, representing the Danish interest in the Poulsen company, told the witness he had received an offer for a large block of stock, apparently made in the interest of the Marconi company, was testified to by Mr. Beach Thompson before the British Parliamentary investigating committee recently.

ANOTHER TRANS-ATLANTIC WIRELESS STATION

There is being erected on Hickory Island, near Tuckerton, N. J., a wireless station which is expected to operate in connection with a similar station being erected near Berlin, Germany, for the transmission direct of trans-atlantic messages.

The antenna which is to be of the umbrella type, will be supported by a steel tower about 800 feet high. The Goldschmidt sparkless system, employing a special high frequency alternator will be used. A brief description of Dr. Goldschmidt's alternator was given in the July, 1911, issue of *Modern Electrics*.

NAVAL FACILITIES INCREASED

Newport, R. I.—The naval wireless station here has been equipped with a small antenna, giving the station a short wave sending capacity of from 300 to 750 meters. The regular set at the station has a sending capacity from 750 to 1,600 meters. The new installation is in accordance with the Berlin treaty, in effect on December 13.

A WIRELESS MAP

A novelty in the way of maps has just been issued by the German Imperial post-office, which has compiled a chart showing the principal wireless telegraph stations in the world. The object is to advertise the facilities now afforded in Germany for "drahtlose" telegraphy. German stations are, of course, given special prominence on the map, and in this connection it is interesting to note that the station at Neuen is claimed to be the most powerful in existence, its range being 2,100 miles. This is 200 miles more than that of Eiffel Tower.—*London Globe.*

WIRELESS TO BE COMPULSORY

Ottawa, Ont.—The government will bring down legislation this session providing for the compulsory installation of wireless telegraph equipment on all steamers of any considerable tonnage plying on the Great Lakes or to the maritime ports of Canada.

QUENCHED NUMBER

The Wireless Screech

OUR MOTTO . . — . . . — .

THE ETHER: ETHERISH

No. 24 B & S | MARCH | Price: Cut Rate

The Wireless Screech

A piercing screech, screeching wireless screechings, tireless and fearless over a peerless world.

Mohammed Ulysses Socrates Pips, Editor-in-Chief.

Mohamet Ullisses Zokrahtes Feeps, Jr., Editeur Assistant en chef.

Pierre Frazzlegook, Editeur du "Daffy Patent Departement."

Hans Schnappa, Editor von das "Oraddle."

Subscription price for above: Two bits.

Single copy: Copyrite.

Forms close in good form without much formality in the former part of the month.

Idiotorial

The Editor wishes to announce the most stupendous, brobdingnagian, colossal, unheard of departure, ever attempted in American magazine culture.

You have seen some minor magazines which have gone as far as to give all kinds of supplements with certain issues, such as portraits of famous ginks, pictures of wireless stations, etc.

All this is tame compared with what the *"Wireless Screech"* will give as supplement commencing with the April number. Take a deep breath, sit down and listen.

THE EDITOR

With each and every copy of the "Screech" we will give ABSOLUTELY FREE a complete copy of a 112-page magazine, size 10¼x6¾ inches. There will never be less than 100 illustrations in this magazine, and it will be without a shade of a doubt the best edited electrical magazine in the world. That sounds big, doesn't it? But we will do it. You have our word for it. And there is no string attached to this marvelous offer; that magazine will be given free; yes, absolutely free, with each and every copy of the *"Screech."* Isn't it wonderful? How can we possibly afford to do it? Well, we have means and ways; you know, where there's a will, there's a Broad-way. Besides, we have made so much coin last year, we can well afford to do it. Order your copy from the news dealer to-day.

P. S.—We forgot to say that the name of the magazine that we are going to give away with the *"Wireless Screech"* is *"Modern Electrics."*

LATEST MARS NEWS.

By His LLS. Hon Spif Marseroni.

Marsona, Ms. Lon 29th 16989

Editor "Wireless Screech," The Earth.

Your message to the further contribution by myself was handed me last morning, and I take extreme pleasure to despatch to you this little contribution via Etherogram, and hope it will reach you in time for your next production.

I have read all of your late *"Screech"* copies lately by means of my "Tele-x-radiophot," which enables us Martians to scrutinize everything on the earth, no matter where located. Although I have found nothing new in the *"Screech"* —some of your jokes being recorded in our annals for over 13,000 years—I have, notwithstanding this, found out that your paper is far ahead of the times—as far as earth-culture on wireless goes.

The most important news on Mars is that on Mezor the 39th of this year, Mars has ceased to be governed. Up to this year we had a Planet Governor, as you no doubt know. He became of less use more and more, as there was nothing to do for him for periods at a time, so it was finally decided to do away with the government altogether. So to-day Mars is un-reigned, the Martians being perfectly able to reign themselves, individually. It may also interest you that we have no courts, no policemen, no weapons, no quarrels, no discords of any kind. It amuses me often when I peep at your poor, quarrelsome earth through my "Tele-x-phot," during my spare time. But I guess it will be thousands of years as yet before you poor earthlings will know how to take care of yourselves. It takes time and time for humans to learn how not to throw away precious energy.

Our brilliant professional inventor, Lakator K. Matorb 310th, has made several unique inventions, which, no doubt, interest your readers.

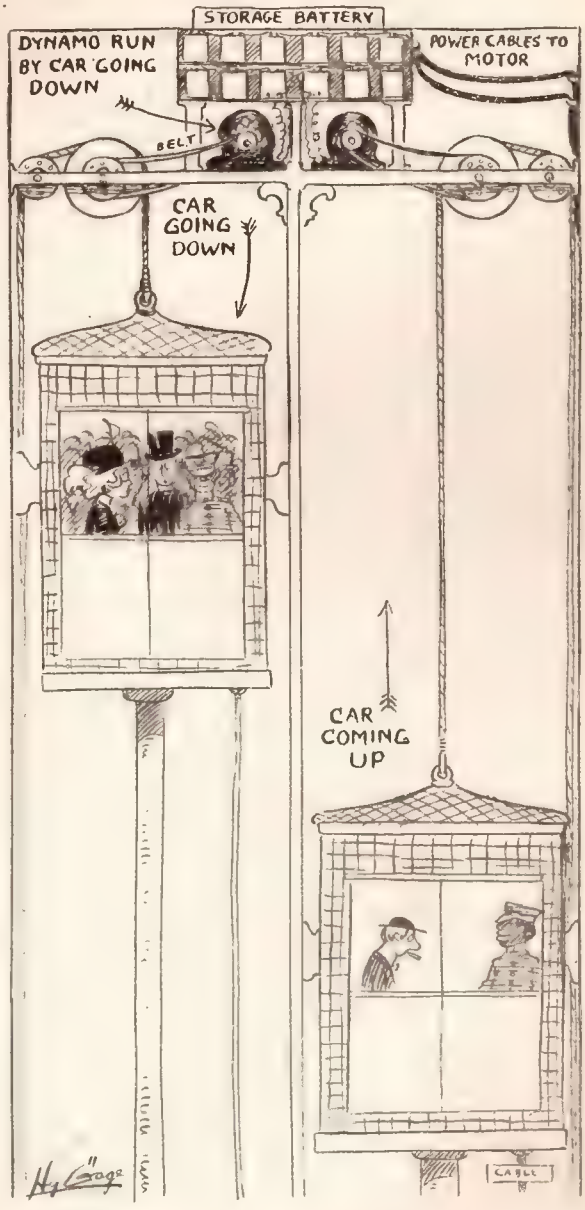
The "Prophetoscope" is one of his most curious inventions. By placing this metal, hat-shaped machine on one's head the recording film will trace a certain curve. The curve, after being translated into words, shows exactly what the wearer of the machine *will think in the immediate future.* In other words, the machine forecasts thoughts! This is very convenient, especially for professional people, and those interested in their future thoughts.

Hon. Lakator has also invented a compressed tablet, containing literature in a diffused state. He calls his invention, the "Literablet." When eating such a tablet, a peculiar electrical action is set up in the stomach, resulting in a series of impulses, which are transmitted through the pneumogastric nerve to the back of the brain. This effect on the brain is similar to the effect of reading on the eye. In other words, the news or literature contained in the compressed tablet, as it dissolves, is gradually conveyed to the mind, relieving one of the eye strain so detrimental to the optical nerve. As soon as the tablet has dissolved, the action, of course, stops, and the tablets are, therefore, constructed in such a manner that they will furnish literature till they are dissolved entirely. An enterprising news periodical has already started to supply its subscribers with news-tablets, and the new plan has made a great hit with us Martians.

You will, of course, like every one else, find at once a serious objection, which is that if any one swallows by mistake, let us say a tablet containing a chemical discussion when he wanted to "read" poetry, what can he do about it? Must he "read" the entire chemical discussion? No; of course, not. He swallows promptly another tablet,

LUTELY FREE. I doped it out at last, Allah be praised, and it is so ridiculously simple that I am half ashamed of it. Well here goes:

The illustration shows two elevators, one down and one up. Suppose the upper is filled with passengers, leaving the 42nd floor. With ten people in the car we obtain a "lift" of 1,500 lbs. dropping some 500 feet down—a tremendous lot of power. *Now this power I have harnessed.* To the shaft of the upper cable drum I connect directly a dynamo which charges the large storage battery as shown. Even one descent of the elevator, should give the battery a good charge which is sufficient to *lift the other car,* all the way up. This car in turn as soon as *it* descends drives a dynamo (2) of its own, which latter charges the same storage battery. Thus it will be seen that the power to run the elevators *costs absolutely nothing.* The more elevators, the better, as they will generate all the more power. If more passengers ride down than come up, it must also be evident that there will be a lot of *surplus power* which can be used to light up the building, and last but not least, drive the revolving doors, thereby saving the initial cost of the dynamo and storage battery in last month's Daffy Patent.



RICHARD LEVERING,
690 W. 112th St.,
New York City.

Efficiency of "Earths" in Radio-Telegraphy

By Charles A. Culver

Continuing an investigation the first part of which was reported in the *Electrical World* of Dec. 2, 1911, the writer has recently studied the relative efficiency of various forms of earth connections at the radiating station. The conditions under which the tests were made were as follows: A radiating station was erected on the Beloit College campus at Beloit, Wis., consisting of a single vertical No. 16 copper wire, 19.6 m. (64.4 ft.) in length, supported by and properly insulated from an iron flagpole. This aerial was connected to a closely coupled transmitting instrument actuated by means of a ¼-kw. transformer. A motor-driven circuit-breaker was inserted in the primary circuit of the above transformer by means of which signals of fairly constant value could be radiated for a period of several hours at a time. A square galvanized wire-screen of ¼ in. mesh, measuring 61 cm. on a side, was buried in the earth at a depth of 18 cm. and served as a standard earth. The radiating system, when connected to this or to the various earth connections referred to later, was carefully tuned by means of a delicate ammeter to the fundamental of the oscillating system. The wave length when connected to standard earth connection was approximately 275 m.

The receiving station was set up at the College Athletic Field, an approximate distance of 1.2 km. from the campus station, and consisted of a single vertical wire 9.5 m. long connected to a loosely coupled transformer and silicon detector. A piece of wire netting laid upon the grass served as earth connection. The shunted telephone method was employed in measuring the incident energy.

The radiating system was connected to various types of earth connections and the efficiency of a given arrangement was determined by noting the relative amount of energy that reached the receiving station. A piece of wire netting of the same dimensions as the standard earth connection when laid upon the grass showed, in a number of tests, a relative efficiency of 100 per cent. In one or two tests it proved to have an efficiency of approximately 75 per cent. The above piece of netting when supported on two-shed porcelain insulators 18 cm. above the ground gave a mean relative efficiency of 65 per cent. A galvanized-iron pipe, 2.5 cm. in diameter and 80 cm. long, driven vertically into the ground, showed a relative efficiency in a number of tests of 100 per cent., but in one or two instances the efficiency fell to approximately 75 per cent.

The efficiency of an earth connection consisting of 30 m. of No. 16 copper wire laid upon the grass proved to be a function of its direction with respect to the receiving station. The resonance curve when employing such a connection was very flat, rendering the measurements difficult to make. However, in all positions such an earth connection proved to be relatively inefficient when compared with the types above mentioned. It was found that when an earth wire was laid upon the grass in such a position that it pointed directly away from the receiving station it had a relative efficiency of approximately 10 per cent. When in a position at 90 deg. to a line joining the two stations the efficiency was somewhat higher, approximately 15 per cent. When the earth wire pointed directly toward the receiving station the relative efficiency proved to be about 20 per cent. All of the above-mentioned tests were repeated a number of times under varying weather conditions, though in general it should be said that the ground was fairly moist. As was to be expected, the numerical values varied somewhat from day to day, but the general results were as already stated.

In addition to the above experiments further tests were carried out in a preliminary way, in order to determine the feasibility of utilizing a continuous metallic conductor as an earth connection between stations. A radiating station, similar to the one described above, was set up near a street-car track and about three blocks distant from a receiving station. Tests were made to determine the relative amount of energy reaching the receiving station when using pieces of wire netting as earth connections and when both stations were connected to the rails. Although no special effort was made to make perfect contact with the rails, and notwithstanding the fact that the earth was very wet owing to recent heavy rains, the energy reaching the receiving station when both stations were connected to the same rail was approximately twice as great as it was when both stations were utilizing netting as earth connections. It is our purpose to conduct further and more careful tests along this line.

The results of the tests herein recorded and those reported in the previous paper tend to show that, in general, there is little difference in the efficiency of metal plates, nets or vertical solid conductors when buried in or laid upon the surface of the earth. This apparently holds true for both radiating and receiving stations, with the possible exception of the wire net when insulated from the ground at the oscillator. However, when employing such a balancing capacity the resonance curve is more sharp than with the other forms of earth connections tested, due doubtless to the diminished damping. The possibility of sharp tuning might in this particular case compensate for the lower gross efficiency value.

When, however, one considers the case of wires used as earth connections the problem presents interesting and important variations. At both the radiating and receiving stations an earth wire exhibits a directive effect, this being particularly true with the receiving

The maximum efficiency apparently when the wires point toward the corresponding station. Upon referring to the previous paper it will be seen that at the receiving station an earth wire several times the length of the aerial shows a decidedly greater efficiency than the other forms of connection tested, while at the radiating station the use of such a wire shows a very poor efficiency. The natural conclusion, from a theoretical point of view, would be that between a given station is to be utilized for both receiving and radiation it would be good practice to combine the two types of earth connections; that is, to install a metal-plate or grid in contact with moist earth and in addition to this to arrange one or more earth wires of as great length as local topographical conditions will permit. Further, if the complicated earth-wire system were so arranged that it could be independently connected to the aerial system when being employed to receive signals, one could not only transmit a greater amount of energy than when utilizing the common form of earth connection, but by a suitable arrangement of parts it ought to be possible to determine the approximate direction from which the signals were being radiated. In short, it would appear to be possible to design a radio-goniometer based on the operation of the earth wires rather than upon the functioning of the aerial wires as in the Bellini-Tosi system.

While, however, from the practical aspects of the above facts, the theoretical questions involved in the unlike behavior of the two systems when operating with earth wires are worthy of careful consideration. A satisfactory explanation of this and related phenomena is, however, not probable until further data are at hand. The preliminary experiments of connecting to an iron rail and other tests of a similar character performed by the writer in 1907[1] tend to show that signaling along a railway system might possibly be carried out with the expenditure of a comparatively small amount of energy.

As a whole, the experiments described above, together with those of True[2] and Kiebitz,[3] tend to show that that part of a radiotelegraphic equipment which forms the earth connection is of equal importance with the aerial part of the oscillating system. In attempting to set electric waves in motion over or in the earth's surface we are dealing with a non-homogeneous conductor of practically infinite extent and having in general a comparatively high resistance. An appropriate consideration of these facts may in time profoundly modify our existing views of the propagation of electric waves.—*Electrical World.*

[1] *Physical Review*, September, 1907.
[2] *E. d. Drahtl. Teleg.*, November, 1911.
[3] *Electrician*, March 8, 1912.

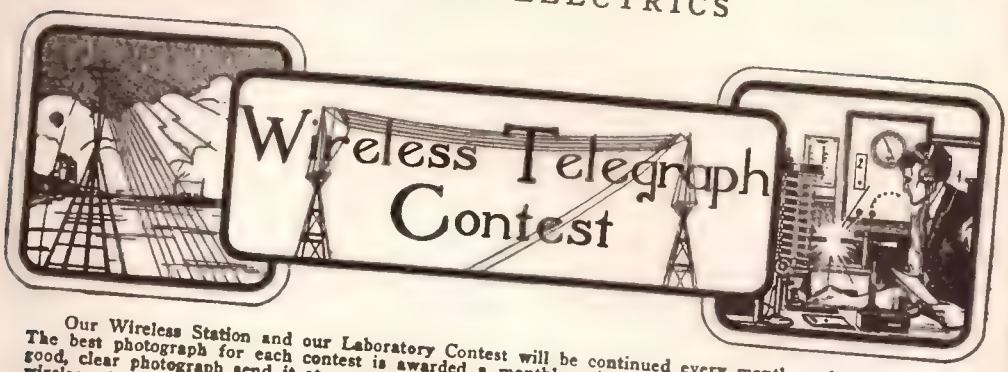
BEST WAVE-LENGTH FOR WIRELESS*

A. H. Taylor, of the University of North Dakota, presented a paper entitled "Optimum Wave-Length in Radiotelegraphy." The author discussed the choice of wave-length with particular reference to the station at the University of North Dakota, upon which he had made experiments. It is already known that the radiation from an aerial is greater for short waves, and so is the current in the aerial for a given maximum potential. Absorption is greater for short waves than for long ones, and the absorption increases with the distance. It is known that the absorption over land is in general greater than over the sea, although the surface absorption of the earth has not been separated from the atmospheric absorption, which produces the great difference between day and night messages. Nearly all detectors respond approximately in such a manner that the audibility of the signal is proportional to the square of the current in the receiving antenna. The audibility is consequently inversely proportional to the square of the distance and to the square of the wave-length and directly proportional to the square of the current in the sending antenna, if absorption is neglected.

The installation at the University of North Dakota is limited to one kilowatt, which is furnished by a self-regulating transformer on a 110-volt, 60-cycle circuit. The primary condenser has usually a capacity of 0.02 microfarad, and is coupled inductively to the aerial, the coupling being loose enough so that the waves transmitted do not differ more than seven per cent. The aerial was of the inverted L type, 27 meters high, 3 meters wide, and 40 meters long, made of six No. 14 aluminum wires. It is connected to the apparatus through a single No 12 stranded copper wire. Its free wave-length is 390 meters. A zinc spark gap was used. Experiments have been carried out to find the connection between the current in the antenna, the power and the wave-length. The square of the ratio of the current to wave-length, divided by the power, was found to be nearly independent of the power, and consequently values of that ratio were computed for constant power. The values so obtained were found to increase with decreasing wave-lengths until a maximum was reached for a wave-length of 0.457 kilometer. For shorter wave-lengths the ratio decreased again. This ratio is called the "distance-factor," since it determines the maximum distance for sending signals with a definite power, when there is no absorption. The working distance of the station sending with one kilowatt to a similar station is calculated for different observed values of the ratio at different wave-lengths. The distance is found to decrease from 343 kilometers for a wave-length of 0.457 to 272 kilometers for a wave-length of 0.73. So far as this station is concerned, it is evident that the shortest

*Abstract of a paper presented at the 64th meeting of the Amer. Assoc. for the Advancement of Science, Cleveland, O., Dec. 30, 1912, to Jan. 4, 1913.

(*Continued on page* 1304)



Our Wireless Station and our Laboratory Contest will be continued every month until further notice. The best photograph for each contest is awarded a monthly prize of Three (3) Dollars. If you have a good, clear photograph send it at once; you are doing yourself an injustice if you don't. If you have a wireless station or laboratory (no matter how small) have a photograph taken of it by all means. Photographs not used will be returned in 30 days.

PLEASE NOTE THAT THE DESCRIPTION OF THE STATION MUST NOT BE LONGER THAN 250 WORDS, AND THAT IT IS ESSENTIAL THAT ONLY ONE SIDE OF THE SHEET IS WRITTEN UPON. SHEET MUST BE TYPEWRITTEN OR WRITTEN BY PEN. DO NOT USE PENCIL. NO DESCRIPTION WILL BE ENTERED IN THE CONTEST UNLESS THESE RULES ARE CLOSELY ADHERED TO.

It is also advisable to send two prints of the photograph (one toned dark and one light) so we can have the choice of the one best suited for reproduction.

This competition is open freely to all who may desire to compete, without charge or consideration of any kind. Prospective contestants need not be subscribers for (the publication) in order to be entitled to compete for the prizes offered.

FIRST PRIZE, THREE DOLLARS

I hand you herewith a photograph of my wireless set. As things are so simply arranged, I do not think that it needs any unnecessary description.

For receiving I am using the U. W. T. Co.'s type E and D hook-ups in connection with Brande's navy type 'phones. I find that type E with a

HEISER STATION

good silicon detector gives the best results. I have a large book of messages that I copied from the majority of the coast and lake stations, ships at sea, and any number of amateurs.

I have two sets for sending, an inch coil operated on a Thordarson step-down, and a 1 kw. Thordarson step-up transformer. As yet I have not had a favorable opportunity to test out my long set.

The aerial is made up of six No. 12 copper wires, spaced 3 ft. apart, 80 ft. long and 75 ft. high at both ends. All my apparatus with the exception of the transformer and the 'phones are of my own make. I would be glad to communicate with anybody in my range. My call letter is "Q."

ERNEST J. HEISER,
Ohio.

HONORABLE MENTION

Herewith please find a photograph of my wireless station, which is known as Wireless Station No. 1 in this vicinity. The receiving instruments are seen on the right hand table. They are all of home construction, except the receivers, which are Brandes Transatlantic type. I also have a Brandes navy type set, which are not shown in the

KARLOWA STATION

photo. The other instruments are a single and a double slide tuning coil. Two detectors are used, galena and silicon, either being thrown in circuit

the center is seen the ... which also controls the ... supply of the transformer.

The sending set consists of a Clapp-... 1 kw. closed core transformer ... condenser, which is not shown in the picture. An oscillation transformer is used for tuning the sending set. The ... gaps are of the rotary and ... types. Either is used by ... a double throw switch to the ... aerial switch. Both the os... transformer and the gaps are ... construction. A protective de... is placed in the primary circuit to ... against kick-backs.

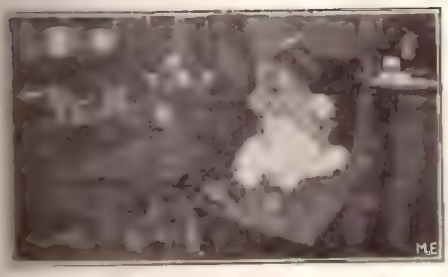
The aerial is 150 feet high and 125 ... long, and consists of four No. 12 ... wires, connected in straight-...

... regularly read Colon, Panama; Ar..., Va., and all the Great Lake ..., besides a number of Atlantic ... stations. The sending range ... to a great extent, but I have ... a distance of 200 miles at night.

ROBERT K. KARLOWA,
Iowa.

HONORABLE MENTION

... th please find description and ... of my wireless station.



MCGRATH STATION
(Mrs. McGrath Receiving)

My aerial is composed of two strands ... No. 12 aluminum wire 150 feet long ... 70 feet high.

Receiving set: Loose coupler, rotary ... condenser, fixed condenser, ... and perikon detectors, and a ... of E. I. Co. 1000 ohm phones.

Sending: ¼ kw. closed core trans... rotary spark gap mounted on a ... base, helix with muffled spark ... inside, glass plate condenser and ...

The whole set was constructed by myself; all metal parts are nickel plated and mounted on hard rubber.

THOMAS M. McGRATH,
New York.

HONORABLE MENTION

Herewith find photograph and description of my wireless outfit.

The receiving set on the left comprises two tuning coils, one double and one single slide, galena and silicon de-

AULD STATION

tector, Blitzen rotary variable condenser, fixed condenser and E. I. Co.'s 1000 ohm 'phones.

The tuning coils are in the cabinet on the left and the variable condenser is inlaid in the top. The tuning coils, cabinet and fixed condenser are home-made.

My sending set consists of ¼ kw. Blitzen transformer, 1-inch spark coil, glass plate condenser, helix and key. The condenser and helix are home-made also. I am making an oscillation transformer from directions given in *Modern Electrics*.

I am a member of a wireless class here, taught by Mr. Keith S. Rogers, the instigator of wireless telegraphy in Prince Edward Island, to whom I owe most of my success.

My aerial is composed of two copper wires 135 feet long. The aerial is 70 feet high at one end and 65 feet at the other.

With this set I have heard as far as NAR, Key West, Fla. My call is XBA.

ERNEST W. AULD,
Prince Edward Island.

HONORABLE MENTION

Inclosed find flashlight of my wireless outfit.

For receiving I have large tuner, fixed condenser, 2,000 ohm head-set, six detectors, variable condenser, and necessary switches.

The sending set consists of a one inch spark coil, key with silver contacts, helix wound with No. 6 aluminum wire, glass plate condenser, zinc spark gap, and one 6 V. 60A storage battery.

JOHNSON STATION

A large antenna switch can be seen at the center of the table.

My antenna is sixty feet long, consists of four copper wires 50 feet from the ground.

This set is the result of a year's experimenting in wireless. I have obtained excellent results from same.

AUGUST JOHNSON,
Michigan.

HONORABLE MENTION

Herewith find a photograph of my wireless station.

My sending instruments are in back of the receiving.

The sending set consists of: a special 2 inch wireless coil, key, sending helix, and sending condenser of 9 plates 8 by 10 inches, on top of which is mounted a zinc spark gap. I use 8 dry cells for operating coil.

The receiving set consists of: double slide tuning coil, silicon and perikon detectors, 1 pair Holtzer-Cabot 2,000 ohm receivers, and fixed condenser.

I also have an extra key and a sounder on the table.

I constructed all the instruments with the exception of spark coil, key, switches and receivers. All of the instruments are mahogany.

COPLAND STATION

My aerial is 60 feet high and 50 feet long, and consists of four No. 14 bare copper wires. My "lead in" connects with the farthest end of the aerial.

HENRY D. COPLAND,
Indiana.

UNITED STATES NOW IN RADIO BUSINESS

Uncle Sam is now in the wireless telegraphy business, or, officially speaking, the radio business, in the United States. This fact will be of wide interest to those clamoring for Government ownership, but they can find little solace in the knowledge that the Government will not compete with the private companies, but will only fill the gaps where "they ain't."

Incidentally the Government rates are the same as those charged by the private companies, no cut having been made. The receipts go to the United States Treasury.

For many years the Government has operated wireless stations in Alaska, handling private and commercial business. The first such station to be thrown open to the public in the United States, however, is that at Key West, Fla., which was opened at midnight December 16th.

TELEFUNKEN CO.'S NEW TOWER

German Wireless Co. new tower at Nauen, now being erected, will rise 917 feet, or 250 feet higher than the structure blown down a year ago. Radius of tower expected to be 5,920 miles, which would make possible messages from Berlin to Chicago.

Wireless Club Notes

THE RADIO CLUB OF BALTIMORE

The Wireless Club of Baltimore was organized on November 18, 1912, and changed into the Radio Club of Baltimore with the following officers: Winn [illegible], president; Raymond Kenney, vice-president; Alvin L. Miller, secretary; Louis E. Richwien, treasurer. Any one in Baltimore city and vicinity desiring full particulars as to membership, etc., in the above-mentioned association should communicate with either the president, 728 N. [illegible] street, or the secretary, 904 N. [illegible] avenue, Baltimore, Md.

WIRELESS ASSOCIATION OF KEENE

The Wireless Association of Keene has been organized and has elected the following officers: Reginald F. Howe, president; Robert H. Barnard, vice-president; Philip Conrad, secretary; [illegible] L. Wilkins, treasurer.

The club was formed with the purpose of promoting the interest of wireless telegraphy. All communications should be addressed to the secretary, [illegible] street, Keene, N. H.

EVERETT WIRELESS ASSOCIATION

A number of youths interested, as amateur operators, in wireless telegraphy, have organized the Everett Wireless Association. It is the purpose of the members to extend the practice of wireless in and about Everett and to study this interesting and most useful form of telegraphy.

The officers of the club are: Arthur [illegible], president, and J. E. Johnson, secretary and treasurer, 2716 Grand avenue, Everett, Wash. Regular meetings are to be held weekly on Monday and Thursday nights.

[illegible] WIRELESS ASSOCIATION

At a meeting held recently a wireless club was organized and the following officers elected: President, E. J. [illegible]; H. N. Swain; Treasurer, P. G. Schmidt; Chairman Social Committee, H. D. Twitchell.

The club was given the name of "The Hamilton Wireless Association." Its purpose is to further the development of the wireless art and bring the enthusiasts into closer contact with each other.

Any communication should be addressed to the secretary, at 405 Franklin street.

IRVING PARK WIRELESS CLUB

A new wireless club known as the Irving Park Wireless Club has been organized at Chicago, Ill. All its members are also members of the W. A. O. A. The club started with eight members.

FRANKLIN WIRELESS TELEGRAPH AND TELEPHONE ASSOCIATION

A new amateur wireless association was organized in the Bronx. This organization exists under the name of the Franklin Wireless Telegraph and Telephone Association. Each member has an entire wireless set. The following officers were elected: president, F. H. Wolff, Jr.; vice-president, Frank Miller; treasurer, Bernard Isaacson; secretary, Reuben Oseroff. The membership of this organization is limited to twenty-five.

At present there is a full membership

YOUNG MARCONIS' WIRELESS ASSOCIATION

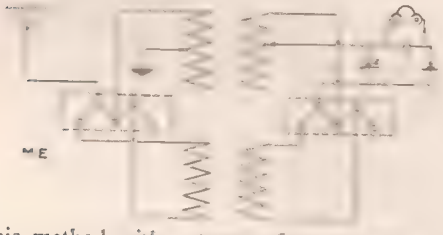
The Young Marconis' Wireless Association, of Youngstown, Ohio, has been formed for the benefit of amateurs and others interested in wireless. The officers elected for the ensuing six months are: B. G. Soderman, president; Cecil E. Brest, vice-president; Paul H. Bolton, 1024 Erie street, Youngstown, Ohio, secretary and treasurer; Merton H. Matthewson, president Western branch, Centralia, Wash. Amateurs in any location are invited to join. A wireless course is being prepared for the benefit of the members.

This department has been started with the idea to encourage the experimenter to bring out new ideas. Every reader is welcome to contribute to this department, and new ideas will be welcomed by the Editors. WHEN SENDING IN CONTRIBUTIONS IT IS NECESSARY THAT ONLY ONE SIDE OF THE SHEET IS USED. SKETCH MUST INVARIABLY BE ON A SEPARATE SHEET NOT IN THE TEXT. The description must be as short as possible. Good sketches are not required, as our art department will work out rough sketches submitted by contributors. IT IS THEREFORE NOT NECESSARY FOR CONTRIBUTORS TO SPEND MUCH TIME IN SKETCHING VARIOUS IDEAS. When sending contributions enclose return postage if manuscript is to be returned if not used. ALL CONTRIBUTIONS APPEARING IN THIS DEPARTMENT ARE PAID FOR ON PUBLICATION.

FIRST PRIZE TWO DOLLARS

STEPPING UP YOUR LOOSE-COUPLER

How many wireless "bugs" throughout the country are using loading coils in the primary of their loose-couplers to get SLI, NAX, and other stations of high wave length? A very large percentage, I dare say, in spite of the loss entailed by this method. There is a very simple way of stepping up the wave length capacity of a tuning transformer, however, which does away with this loss and gives very satisfactory results. A well known experimenter of Cambridge, Mass., has heard Clifden, Ireland, on different occasions, using



this method with a tuner of 1500 meters capacity, in connection with an aerial of fairly small size.

Let us suppose we have a receiving transformer of 150 turns primary, 200 turns secondary, receiving on a medium aerial waves up to 1,500 meters. Wishing to go up to 2,500 or 3,000 meters, we set about to make an auxiliary transformer as follows: We turn two discs of wood or hard rubber with a diameter half an inch greater than that of the primary coil of our loose-coupler, and thick enough to allow a groove a quarter of an inch wide and half an inch deep in each disc. If a lathe is not handy, saw out two discs of quarter inch wood, and glue on each side cardboard discs having an inch greater diameter. Then we wind 150 turns of wire on each of these discs—number 28 double silk covered is very good—getting the winding of each in the same direction from the center. These are then held together by a small bolt and nut near the edges.

We have then a transformer with the number of turns constant, but the coupling variable. To loosen the coupling, simply twist the coils so they do not directly superimpose. A place can readily be found by experiment where the coupling works best. This is generally when the coils are about three-quarters of an inch from being directly over each other. They are connected to the loose-coupler through two double-throw switches as shown in the diagram. This enables either coil to be cut in at will. The action of the set is then—the loose-coupler alone up to 1,500 meters—then the auxiliary coils cut in, and we start at the beginning of the loose-coupler again, this time going from 1,500 up to 2,500-3,000 meters. If we wish to go higher yet, duplicate coils may be made and cut in with the first ones, or by themselves. As it is little trouble to wind the discs, it is good to experiment around for certain stations, and have a "Glace Bay coil," an "NAX coil," etc. The compactness of these coils is a recommendation to many. I believe the real feature, however, is the ability to get either very long waves (as long as you wish to wind your coils for), or very short waves, without the great loss caused by a long "dead end" while getting short waves, which would be the case if using a loading coil in the ordinary way.

Contributed by

H. E. RAWSON.

Note.—Care should be taken to connect these coils in series with the loose coupler coils so that the currents induced in the two secondaries do not oppose each other.—Ed.

SECOND PRIZE ONE DOLLAR

A HELIX MADE INTO AN OSCILLATION TRANSFORMER

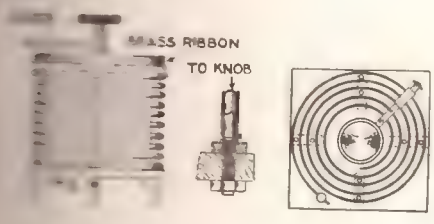
As almost every experimenter is aware, under the new wireless law no instrument is allowed in the transmitting set which interferes with the use of a pure and sharply

For this reason the ordinary [illegible] is placed under the ban, [illegible] will send out a double wave, [illegible] wave being about one-sixth of the [illegible]

[illegible] many amateurs possess excellent [illegible] would fain part with them. Also [illegible] coupled instrument costs money and [illegible] very hard to construct. With the [illegible] herewith and the description, the [illegible] able to convert his helix [illegible] form of oscillation trans-

[illegible] per is unaltered, the change [illegible] a spiral helix of copper or [illegible]. The spiral is placed on top of [illegible] and is built in any one of the va- [illegible] that have been described in *Mod-* [illegible], the best method being prob- [illegible] the use of a slotted cross in which the [illegible]

[illegible] adjustment is effected through a slider [illegible] knob. The knob is set ex- [illegible] in the center of the spiral and is held [illegible] by nuts on the supporting rod. The [illegible] of fixing the rod so as to rotate easi- [illegible] in the drawings.



The slider is an ordinary tuning coil slider [illegible] the contact consists of a slotted brass [illegible] soldered on to one side. It is now [illegible] seen that if the hard rubber knob is [illegible] that the slider will move outward or [illegible] to correspond with the changing di- [illegible] of the turns of the spiral.

This apparatus is very efficient and is a [illegible] saver when compared with one of [illegible] inductively instruments in which the coils [illegible] moved backwards or forwards for ad- [illegible]

PAUL HORTON.

AN EXPERIMENT WITH STATIC

[illegible] persons no doubt have noticed that [illegible] possesses a certain amount of elec- [illegible]

[illegible], except a bald headed man, can [illegible] a [illegible] tube on their hair by simply [illegible] one end of the tube by the metal [illegible] and bringing the other end down through the [illegible] with medium force. The tube lights [illegible] each time it is drawn through the [illegible]

[illegible] three or four times and then touch [illegible] someone's face or hands; the tube [illegible] again for a second. This experiment [illegible] in the dark.

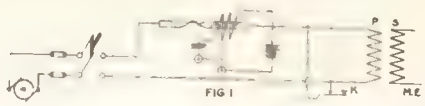
FRANK COPEMAN.

MEANS FOR OPERATING A SPARK COIL ON 110 VOLTS WITHOUT AN INTERRUPTER

The accompanying diagrams show an arrangement which will enable anyone having 110 volts direct or alternating current in his house to cover many more miles with a spark coil than would be possible with an interrupter.

It is first necessary to make a small adjustable arc-light, shown in Fig. 2.

The base may be any convenient size, in



my case it was 18" x 6". Near one end are mounted two pieces of wood about 2 inches apart and 2 inches high. These serve as supports for the adjusting screw of one carbon, B. Very good supports for that carbon are regular porcelain cleats. Two of these may be fastened to the base in a position to permit the carbon to slide freely over the grooves. The adjusting screw may be a small cog wheel from an old clock, but a better one may be made by cutting a small disk of wood and facing it with leather.

The contact for the carbon is a piece of thin spring brass fastened under a binding post and bent to make a good contact on the carbon.

Next, a good solenoid with a ¼" hole is mounted about 3 inches from the other end of the base. If you have a solenoid with a larger hole, a block with a ¼" hole may be mounted at each end of it. Be sure to have the holes in perfect alignment.

A solenoid the right size is made by winding from six to eight layers of No. 16 B. & S. gauge S. C. C. wire on a ½" tube. It should be about 6 inches long. The tube should be of fibre.

A ¼" iron rod 8 inches long with a clip

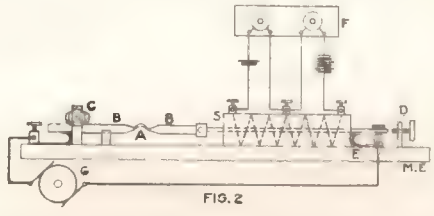


FIG. 2

or cup on one end should now be procured and slid into the solenoid so that 1 inch is exposed on either end.

Now, a carbon should be fitted on to it and the apparatus adjusted so that when the carbons touch, the iron rod protrudes about ¼" from the end of the solenoid away from the carbon.

Now mount a brass post 2 inches from the end of the solenoid away from the carbons. This should have a long set screw run through it so that the distance the iron rod slides back may be regulated. Have this screw at least 2 inches long, because a great deal of fine adjusting is done with it.

Another spring brass contact may now be mounted for the iron as shown at E, Fig. 2.

In Fig. 2 the carbons are shown at B and B′, the adjuster at C, the solenoid at S and the rear adjusting screw at D.

On a small board must be mounted two push buttons and four binding posts as shown at F, Fig. 2. This should be close at your left hand on the operating table, for when all is adjusted right, a push of both buttons opens the carbons and strikes the arc, and a push of button C closes the carbons. Both buttons should be pushed in opening because one retards the other and the carbons open slowly, thus preventing a break in the arc.

It would be a good plan to have a primary circuit cut-out on the aerial switch so that when you were finished sending all you would have to do would be to throw the aerial switch on the receiving side and push button C, thus necessitating the throwing of only one switch.

With this hook-up the key would have to be reversed and the contacts immersed in oil, as shown in Fig. 3. The key will arc badly if it is not oil break.

The primary of the coil is shunted around the key as in Fig. 1 and the secondary connections are made to suit special requirements.

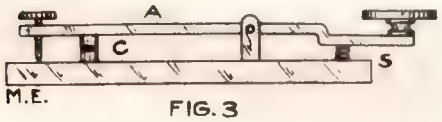


FIG. 3

The action is like this:—When the aerial switch is thrown on the transmitting side, and the buttons pushed, you have just an arc-light. Now when the key is depressed, the current flows through the primary coil, setting up high frequency oscillations in the secondary circuit of low voltage but very high amperage, thus producing a short but extremely hot spark. This is the ideal spark for sending, which is proved by the fact that I sent 5 miles with a two-wire aerial in my room and 38 miles, overland, with a 4-wire aerial 50 feet high outdoors with a 2-inch coil.

If the operator can see the arc from where he sits when sending, a piece of smoked or colored glass should be inserted between him and the arc, because the ultra-violet rays from the arc will injure the eyes. But, as these rays are arrested by glass, it will be safe if a window is provided.

Contributed by

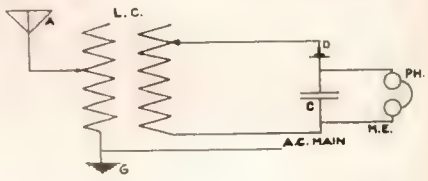
H. C. HUNTER

HUM ELIMINATOR

I have been a reader of *Modern Electrics* for about a year and a half, and during that time I have seen many questions, "When I hook up so and so I get a humming in my phones and want to know how to stop it."

I was bothered that way, too. I asked this, also, and was advised to change my aerial. This was impossible, for I already had two 75-foot poles up. So I did some experimenting.

For the benefit of those bothered as I was I submit: If you have alternating current in your house, find out by experiment which of the two wires does not effect the meter when the wire is grounded, then ground it on your wireless ground near the instruments with a switch to open when you are not "on," so it won't register other people's more than



necessary. This works with any hook-up.

Contributed by

R. S. CHILDS.

Note.—The cause of these humming noises is often inside as well as outside the station, and often difficult to locate. We know of one station where the hum did not manifest itself until the operator, or someone else, touched a binding post or any other metal part forming part of the detector circuit. So long as we "kept our hands off" the set was perfectly quiet. The cause was never discovered.—ED

TELEPHONE WIRES FOR AERIAL

I refer to questions (2266) and (2271) of the January, 1913, issue of *Modern Electrics*.

For the past three years I have used my telephone wires for aerials and have obtained excellent results with very simple apparatus. Perhaps my method may be of some help to the writers of questions (2266) and (2271).

A fixed condenser of one micro-farad will be required. It is well to try different capacity condensers until the best results are obtained. They may be home-made or purchased at any supply-house. It is important that the condenser used should not be short-circuited, as the telephone line may be put out of order.

In Fig. 1, a diagram is given to show the

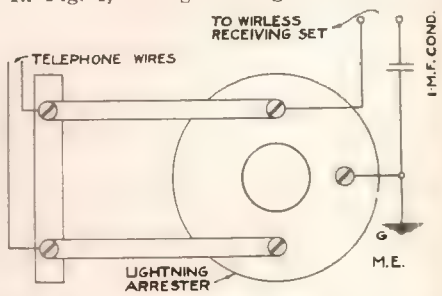


FIG. 1

connections. For distances of three or four miles I used a silicon detector and a seventy-five ohm telephone receiver. At night I received messages at distances of twenty to thirty miles. By using more instruments much better results are obtained.

Contributed by

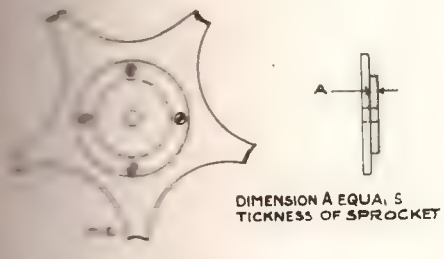
J. YOUNG.

SPARK GAP HINTS

[illegible] which may be useful to your [illegible] to the fact that the Wireless [illegible] passed, which practically [illegible] are a rotary gap, and that the [illegible] one that will give satisfactory results will be too much for some of [illegible] and they will have to close the [illegible] of their station, is the reason [illegible] this in.

[illegible] has tried to make a rotary [illegible] out of wood or fibre as described [illegible] of the back numbers of *Modern Electrics* and knows how hard it is to make the [illegible] to get the plugs all the same [illegible] and the same length. Of course, you [illegible] rotary for $10 or $15, or buy [illegible] wheel for $5 or $6, but still this [illegible] is entirely too high for most beginners. [illegible] which is just as good, if [illegible] in several ways, than the wheels [illegible] high prices, is the front sprocket [illegible]. These sprockets can be purchased at prices ranging from ten cents for [illegible] to $1 for the largest, and they [illegible] with any number of teeth. The [illegible] in the center of the wheel is a [illegible] to the purchaser, because he [illegible] bolt up with wood or fibre as [illegible], and it will give him just that [illegible] between the wheel and the [illegible].

[illegible] thing is the speed at which to run [illegible]



[illegible] A motor that will run at the [illegible] for the best results is a very [illegible] to get; but if you can obtain a [illegible] with a speed of 800 to 1000 R.P.M. [illegible] will be very easy to make it into a motor [illegible] with a very high speed can be obtained. First remove the pulley, and in its place mount a large cogwheel which has been [illegible] from a clock; then take a smaller [illegible] from the same clock, take out the [illegible] being careful not to bend the wheel, [illegible] a piece of 3/16 inch brass rod and [illegible] in the wheel large enough to pass [illegible] and fasten it in place with a drop or [illegible] solder; then make two bearings for [illegible] to run in, leaving about two inches [illegible] extending through the one bearing, [illegible] the spark wheel on this end.

[illegible] fasten the motor and the cogwheel [illegible] the spark wheel on to a base of wood [illegible] rubber. Connect up the motor with [illegible] in the circuit and try out the motor [illegible] speed, and see that everything [illegible] smoothly; then try the spark; if the [illegible] seem to move or if the spark seems to be ragged, try the motor on the next speed, and so on until the teeth seem to stand perfectly still and the spark is no longer ragged. No wiring diagram or size is stated, as it must be made and connected to suit the user.

Contributed by

P. J. THEISEN.

CRYSTAL CONTACTS

After considerable experimenting with silicon and galena for detector crystals I have found:

(1) That while silicon is sensitive with almost any metal contact, the only one that will not knock out easily is antimony. Silicon and antimony make a very sensitive detector, which is harder to knock out than any other crystal detector I have used.

(2) That while galena requires a very fine point and very light adjustment (Dr. Pierce, of Harvard, recommends a very fine iron wire contact), and while all contacts knock out quite readily, the most sensitive one is made by graphite—a piece of lead from a hard lead pencil is just the thing. Graphite and galena make what is probably the most sensitive crystal detector known to-day.

Contributed by

H. E. RAWSON.

Note.—The combination of galena and tellurium is said to be still more sensitive than galena and graphite.—ED.

SPARK TESTER

It has been known for a long time that a rapidly moving mirror would separate a series of very rapid sparks into its integral parts. For instance, the oscillation of the discharge of a leyden jar is proven by this means, and likewise we may separate the sparks or discharges across a spark gap. The manner of accomplishing this is shown in Fig. 1. The mirror is placed near the gap and is rapidly oscillated back and forth. The mounting shown is not even necessary, as a piece of silvered glass may be held in the hand and moved up or down, or vibrated sidewise. If this is done

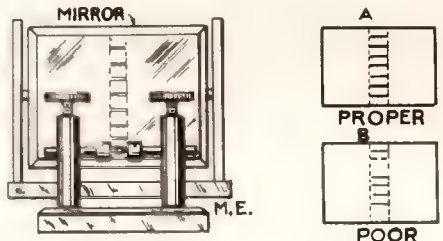


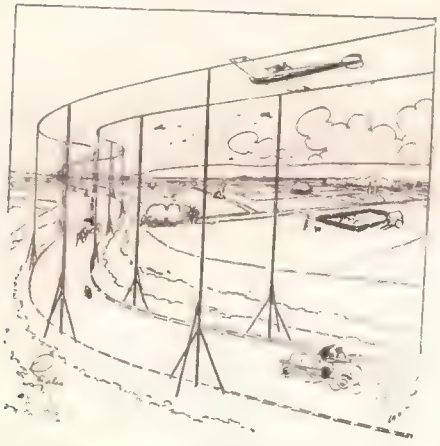
FIG. 1

while a spark is passing the image in the mirror will have a ladder-like appearance. If the coil or rotary gap is working properly; that is, the coil vibrator making a spark at each stroke, or the rotary is in synchronism with the rest of the circuit, then the image will look as in A, Fig. 1, and if otherwise the appearance of the spark will be somewhat

(*Continued on page* 1293.)

Flying Sparks

THE ULTIMATE



Making aeroplaning safe and sane

THE LITTLE TOO MUCH

It was a beautiful evening and Ole, who had screwed up courage to take Mary for a ride, was carried away by the magic of the night.

"Mary," he asked, "will you marry me?"

"Yes, Ole," she answered softly.

Ole lapsed into silence that at last became painful to his fiancee.

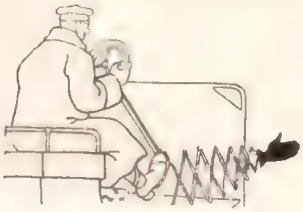
"Oh," she said desperately, "why don't you say something?"

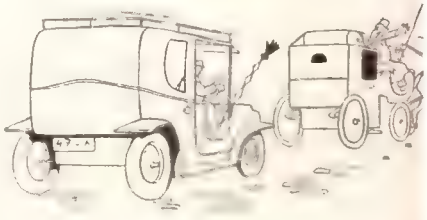
"Ay tank," Ole replied, "they bane too much said already!"—*San Francisco Star.*

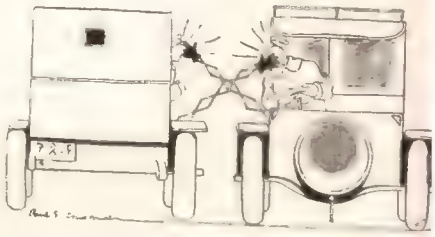
THE AMERICAN BILLIONAIRE

and how he keeps in touch with his office while on the road—as seen through French eyes.

A GOOD INVENTION







—to tell the car behind when you stop. It is also help to quarrelsome taxi drivers—*Pêle Mêle.*

EMBARRASSING

A tramp knocked at the door of a lonely spinste home.

"Kind lady, arst yer 'usband if 'e ain't got a o pair o' trousers to give away."

The spinster, not wishing to expose her solitu replied:

"Sorry, my good man, he—er—er—never wea such things."—*Harper's Magazine.*

FOR REFERENCE

"See that man over there. He is a bombastic mut a wind-jammer nonentity, a false alarm, and an e cumberer of the earth!"

"Would you mind writing all that down for me?"

"Why in the world——"

"He's my husband, and I should like to use it h him some time."—*Houston Post.*

The Inevitable Cross-Examination

"Wire you insulate?" asked the wireman's bett half when hubby cautiously inserted the latch-key a 2 a. m. the other morning.

WHY MAN OF TO-DAY IS ONLY 50 PER CENT EFFICIENT

By WALTER GRIFFITH

If one were to form an opinion from the number of helpful, inspiring and instructive articles one sees in the public press and magazines, the purpose of existence is to increase our efficiency, he would believe that the entire American Nation is striving for such an end—

And this is so.

The American Man because the race is harder every day; competition is keener and the stronger the man the greater his chance to win. The stronger the man the stronger his will and brain, and the greater his ability to match wits and win. The greater his confidence in himself the greater the confidence of other people in him: the keener his wit and the clearer his brain.

The American Woman because she must be competent to rear and manage the family and home, and take all the thought and responsibility from the shoulders of the man whose present-day business burdens are all he can carry.

But what are we doing to secure that efficiency? Much mentally, some of us much physically, but what is the trouble?

We are not really efficient more than half the time. Half the time blue and worried—all the time nervous — some of the time quite incapacitated by illness.

There is a reason for this—a practical reason that has been known to physicians for quite a period and will be known the entire World ere long.

The reason is that the human system cannot, and will not, rid itself of all the waste with it accumulates under our present mode of living. No matter how regular we are, the food we eat and the sedentary life we live (even though we do get some exercise) make it impossible; just as impossible as it is for the grate of a stove to rid itself of clinkers.

And the waste does to us exactly what the clinkers do to the stove; make the fire burn low and inefficiently until enough clinkers have accumulated, and then prevent its burning at all.

It has been our habit, after this waste has reduced our efficiency about 75 per cent., to drug ourselves; or after we have become 100 per cent. inefficient through illness, to still further attempt to rid ourselves of it in the same way—by drugging.

If a clock is not cleaned once in a while it clogs up and stops; the same way with an engine because of the residue which it, in itself, accumulates. To clean the clock, you would not put acid on the parts, though you could probably find one that would do the work, nor to clean the engine would you force a cleaner through it that would injure its parts; yet that is the process you employ when you drug the system to rid it of waste.

You would clean your clock and engine with a harmless cleanser that Nature has provided, and you can do exactly the same for yourself as I will demonstrate before I conclude.

The reason that a physician's first step in illness is to purge the system is that no medicine can take effect nor can the system work properly while the colon (large intestine) is clogged up. If the colon were not clogged up the chances are 10 to 1 that you would not have been ill at all.

It may take some time for the clogging process to reach the stage where it produces real illness but, no matter how long it takes, while it is going on the functions are not working so as to keep us up to "concert pitch." Our livers are sluggish, we are dull and heavy—slight or severe headaches, come on—our sleep does not rest us—in short, we are about 50 per cent. efficient.

And if this condition progresses to where real illness develops, it is impossible to tell what form that illness will take, because—

The blood is constantly circulating through the colon and, taking up by absorption the poisons in the waste which it contains, it distributes them throughout the

system and weakens it so that we are subject to whatever disease is most prevalent.

The nature of the illness depends on our own little weaknesses and what we are the least able to resist.

These facts are all scientifically correct in every particular, and it has often surprised me that they are not more generally known and appreciated. All we have to do is to consider the treatment that we have received in illness to realize fully how it developed, and the methods used to remove it.

So you see that not only is accumulated waste directly and constantly pulling down our efficiency by making our blood poor and our intellect dull—our spirits low and our ambitions weak, but it is responsible through its weakening and infecting processes for a list of illnesses that if catalogued here would seem almost unbelievable.

It is the direct and immediate cause of that very expensive and dangerous complaint—appendicitis.

If we can successfully eliminate the waste all our functions work properly and in accord—there are no poisons being taken up by the blood, so it is pure and imparts strength to every part of the body instead of weakness—there is nothing to clog up the system and make us bilious, dull and nervously fearful.

With everything working in perfect accord and without obstruction, our brains are clear, our entire physical being is competent to respond quickly to every requirement, and we are 100 per cent. efficient.

Now this waste that I speak of cannot be thoroughly removed by drugs, but even if it could the effect of these drugs on the functions is very unnatural, and if continued becomes a periodical necessity.

Note the opinions on drugging of two most eminent physicians:

Prof. Alonzo Clark, M. D., of the Ne York College of Physicians and Surgeon says: "All of our curative agents are poi ons, and as a consequence, every dose d minishes the patient's vitality."

Prof. Joseph M. Smith, M. D., of th same school, says: "All medicines whi enter the circulation poison the blood in th same manner as do the poisons that produ disease."

Now, the internal organism can be ke as sweet and pure and clean as the extern and by the same natural, sane method— bathing. By the proper system warm wate can be introduced so that the colon is pe fectly cleansed and kept pure.

There is no violence in this process—i seems to be just as normal and natural a washing one's hands.

Physicians are taking it up more widel and generally every day, and it seems a though everyone should be informed tho oughly on a practice which, though s rational and simple, is revolutionary in i accomplishments.

This is rather a delicate subject to wri of exhaustively in the public press, bu Chas. A. Tyrrell, M. D., has prepared an in teresting treatise on "Why Man of To-da Is Only 50 per cent. Efficient," which trea the subject very exhaustively, and which h will send without cost to any one addressin him at 134 West 65th Street, New York and mentioning that they have read this ar ticle in *Modern Electrics*.

Personally, I am enthusiastic on Interna Bathing because I have seen what it ha done in illness as well as in health, and believe that every person who wishes t keep in as near a perfect condition as is hu manly possible should at least be informe on this subject; he will also probably lear something about himself which he has neve known through reading the little book t which I refer.

shown at B. This is a very practical test and should be used by every operator.

Contributed by

PAUL HORTON.

LOADING COIL

A loading coil as explained below will give excellent results and the cost to make it is very low.

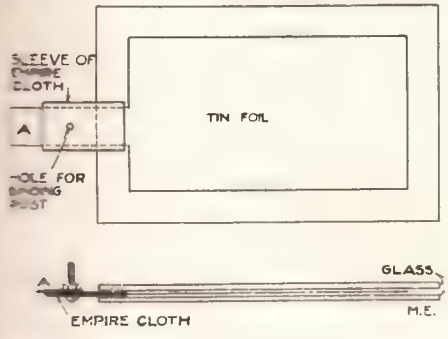
Procure a piece of heavy cardboard 6" by 20" and bend it into a cylinder, overlapping one inch for glueing. If desired a piece of heavy paper may be glued over the cardboard. Starting from the top, make a small hole every ¾" for the taps. About 6-7 oz. No. 28 enameled or D. C. C. wire will be necessary. Starting from the top hole insert about one foot of wire into the hole and start winding until the next hole is reached where a loop one foot long is made and inserted in the hole for connections. Continue until the last hole is reached, the wire is cut, leaving the same amount. This process of winding and taking taps leaves the wire in one piece, avoiding unnecessary resistance. About one inch from the bottom make a row of seven small holes and beginning with the top one bring out the taps in succession from left to right, and connect to a seven-point switch mounted on the base of the coil. Connect binding posts to the first tap and the switch lever and the coil is finished. A top may be put on if desired. This coil gave the writer excellent results.

Contributed by

W. B. NEUMANN.

SENDING CONDENSER LUG PROTECTION

In the construction of sending condensers there is considerable leakage about the tinfoil lugs and also danger of the lugs being broken off. To overcome this I put a sleeve of Empire cloth about the lug and shellacked it down. The binding post passes through the Empire cloth, as shown in the accompanying drawing, and the portion A of tinfoil protruding from the cloth sleeve is overlapped onto the binding screw. This maintains a strong and good connection to the condenser.



Contributed by

ALEX POLSON.

DETERMINING HEIGHT OF AERIAL

I notice in a recent issue an article by Paul Horton, giving a method for determining the height of an aerial. While this method was entirely satisfactory for a certain ancient Egyptian philosopher who wanted to ascertain the height of a pyramid standing on a broad desert, I feel sure that many amateurs found it impossible to measure the shadow of their pole without climbing the side of an adjoining building against which a distorted portion of the shadow was thrown

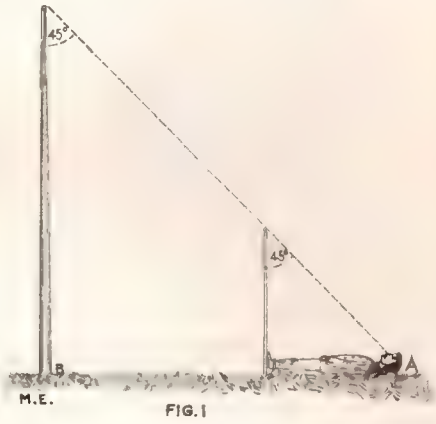


FIG. 1

The method given below may be used to measure almost any structure or pole, regardless of location.

Secure a stake which is tall enough to reach to the level of your eyes when one end is driven into the ground. Place this at some distance from the base of the mast and,

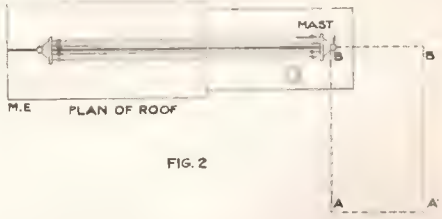


FIG. 2

lying flat, with your feet against the stake, as shown in Fig. 1, look over the end of the stake at the top of the pole. Then vary the position of the stake until a spot is found where the stake's tip appears to coincide with that of the pole. The distance between A and B will then be equal to the height of the mast.

For aerials mounted on housetops the distance between A and B may be measured by extending parallels and measuring between A' and B', as shown in Fig. 2. While there are a few instances where this process will not work, it will be found satisfactory in the majority of cases.

Contributed by

STUART R. WARD.

Packard

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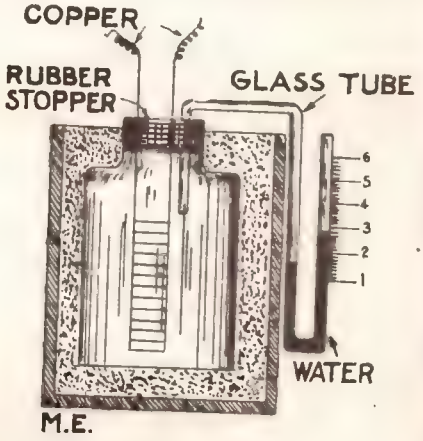
AN EASILY CONSTRUCTED AMMETER

This instrument is only an adaptation of the principle of the Reiss Instrument as was described in a back issue of this paper. The apparatus in question consisted of a glass bulb of peculiar construction having several sealed in wires. These facts place the construction out of the reach of the average equipped amateur. However, the modified form shown below may be easily built using the most simple materials.

It consists, as is shown in the diagram of a wide necked bottle, securely sealed with a rubber cork through which is passed two stout copper leads and one glass tube. Between the two leads the fine copper wires are soldered, and should range in size from No. 30 to No. 40 B. & S. gauge, according to the wattage of the transmitting set, the number of wires will also vary somewhat with the frequency or the readings will not be absolutely true. As was explained in the above mentioned article the instrument is calibrated with a low tension direct current, it being connected in series with a battery and another ammeter. The heat produced in the fine wire causes the air to expand which, in turn, causes a corresponding movement of



the water column in the U tube. Passing ½, 1, 1½, etc., amperes through the instrument mark the position of the water column. Now pass the high frequency current, first through a hot wire instrument and then through the one being tested and see if the readings agree; if they do not vary the number and size of the wires until they do. Very likely a considerable amount of experiment will be needed to calibrate the instrument.

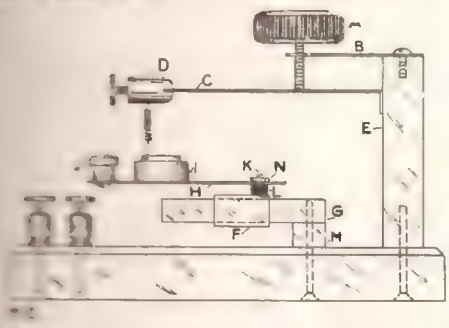
It is well known that a gas expands when heated and contracts when cooled, and hence if the above apparatus were not protected the water in the tube would act as a thermometer as well as an ammeter, and for that matter it will act as a small scale barometer whether or not we protect it. Thus there are many points of error in the instrument. However, we may eliminate most of the in accuracy by placing the bottle in a box of sawdust, and by moving the rubber cork up or down.

Contributed by

PAUL HORTON.

DETECTOR STAND

I have for some time been noticing detectors that some of the readers of *Modern Electrics* have been constructing, but think the one I here describe is by far superior. A is an electrose knob; B is a piece of thick brass and is threaded at one end and has a hole at the other; C is a piece of ordinary spring brass and is soldered to E; D is a piece of battery binding post as on the zinc of a dry battery and can hold different wires for different minerals; E is a piece of ⅜" square brass rod and is drilled and threaded



at both ends with an 8-32 tap; F is a piece of square brass tubing and the bolt, K, is soldered to it; G is a piece of ¼" square brass rod; H is a piece of spring brass; I is a detector cup off the carbon of an old dry battery and is soldered to the brass spring, H; J is an electrose knob; L is a small spring; M is a piece of solid rod with a 8-32 hole in it and a bolt run through and soldered to G with nut; N is a nut to hold H to the piece, F, and should not be tightened too much.

This detector can be regulated by electrose knob A; and the cup can be slid back and forth or sidewise or can be taken off for new material all by the knob, J.

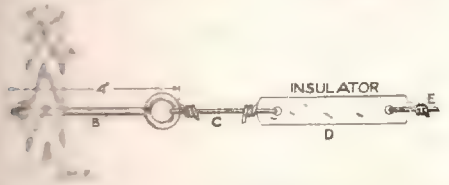
This has been used for over a year among Chicago amateurs.

Contributed by

JAS. L. NEWPORT.

A GOOD AERIAL ADJUSTER

Many amateurs have a good bit of trouble in getting the wires in their aerial stretched even. I think this will overcome this trouble: Get a ¾-inch eye-bolt (B) about 4 inches long and fasten to spreader (A) as shown in diagram. To it fasten the insulator (D) with a short piece of wire (C), and from



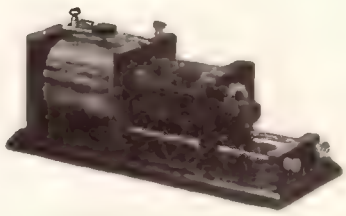
the other end of the insulator (D) swing your aerial wire (E).

I think any person placing one of these as described, at one end of each wire, will be able to stretch the wires so the sag in all of them is the same.

Contributed by

CLARENCE L. BROWN.

EFFECTIVE TUNING



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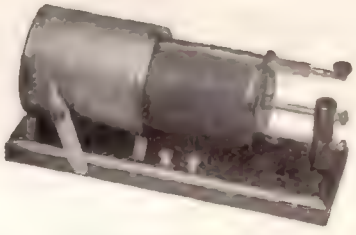

Receiving Transformer No. 343

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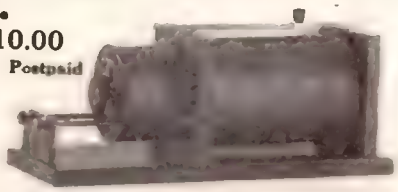

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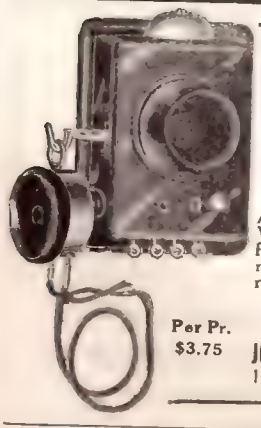

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Get a glass jar about 3 inches in diameter and about 6 inches high. Next make a zinc cylinder and fit it into the glass jar. A piece of blotting paper should be glued to the zinc, and a binding post soldered to the zinc to make a good connection.

Now get a carbon rod (a carbon from an old battery will do), and place it in the center of the jar and then pour in the paste which consists of three parts water, one part muriatic acid, four parts of crushed charcoal, two parts flour, one part plaster-of-Paris.

After the paste is in pour sealing wax over the top to keep it from evaporating. It is ready to use about 3 hours after making.

R. F. HEATH.

NOVEL SIGNAL AMPLIFIERS

Fig. 1 shows a simple sound or signal intensifier. It consists essentially of a magnet and gas chambers and a variable contact or resistance. To construct one proceed as follows: Obtain a piece of wood, oak is best, and bore a hole ⅞-inch in diameter through

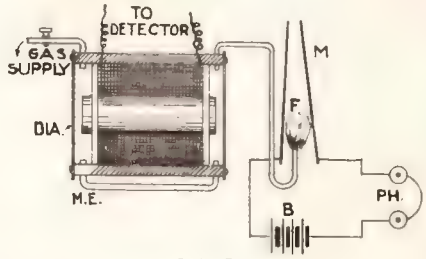


FIG. 1

the center, the length being about 2 inches. Now obtain a round bar magnet ¼ inch in diameter and about 1½ inches long; fix a round fibre head on each end, the fibre pieces being very nearly ⅞ inch in diameter. Insulate the iron thoroughly and wind the space full of No. 40 to 45 copper wire, silk or enamel insulated, bringing the two ends out through the fibre heads. Slip the magnet inside the hole in the block of wood and pour shellac all around to prevent the gas leaking through. The gas pipes shown in the drawing are made of ⅛ inch brass tubing and are fastened in place with shellac or glue. The diaphragms shown on each end are made of very light ferrotype iron. A rubber ring should be placed between it and the wood and then tacked in place.

The last outlet is extended to a V-shaped burner, where the flame plays between two metal plates. The plates are inclined and are connected in series with the regulation 1000 ohm phones and 8 or 10 dry cells, the miniature type described in a back issue being very suitable. If now the coil is connected to a detector and a message is coming in, the movement of the two end diaphragms causes variations in the gas pressure, which causes fluctuations in the flame. This increases or decreases the resistance, which fact is attested to by the very loud tone in the receivers.

Another form of amplifier is shown in Fig. Here it is seen that a heavy armature actuates a diaphragm, which causes a very considerable volume of sound to be emitted by the horn. The novel and essential feature of this instrument is embodied in the use of a very heavy iron armature ⅛ inch thick and having only one magnetic gap. The ordinary phone having only a thin diaphragm and two gaps is very inefficient. The magnets may be any high resistance type not having soft iron cores. If the builder con-

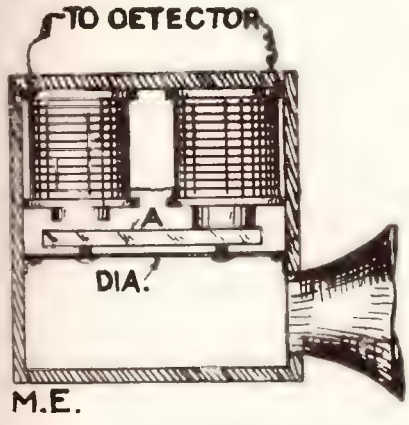


FIG. 2

structs them himself, he should wind them to 2000 ohms. The armature is screwed fast to the longer core and the gap should measure about 1/32 inch. The sounding diaphragm is mounted over a box which is connected to a horn. If the reproducer of an ordinary phonograph could be obtained, then just connect the mica or glass disk by means of a brass rod to the armature. Upon the passage of an intermittent current the noise produced will be a revelation to most experimenters. This arrangement may be used as an electric horn providing the coil is wound to about 4 or 5 ohms with No. 24 DCC wire.

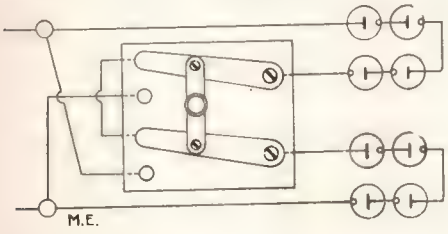
Contributed by

PAUL HORTON.

BATTERY CONNECTING SWITCH

Enclosed please find sketch of pole changing switch, arranged so as to connect the batteries in series or series multiple.

I consider this an improvement on Chas.



Huppert's contribution in the January number, as there is only one switch, and no danger of short circuit as there is by leaving both switches in.

Contributed by

MARVIN MOTTASHED.

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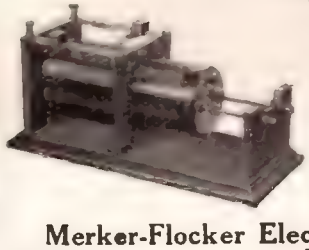

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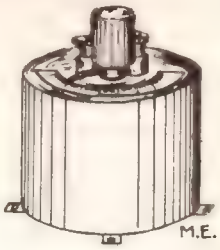
INCREASING CONDENSER CAPACITY

Some amateurs who have the small Murdock variable condensers find the capacity to be too small for the circuit in which they have it connected.

It is well known that castor oil used as a dielectric increases the condenser capacity about five times.

The immersion of this condenser in castor oil seems impossible, but it may be done in the following manner:



Procure a can; a ten-cent Heinz's Beans can is just the right size. Remove the transparent sides from the condenser and cut away enough of the bottom base to make its diameter small enough to fit into the can. Solder three or four pieces of sheet metal to bottom of can for fastening it to table. Cut or melt top off of can, being careful not to cut away too much. Fill can two-thirds full of castor oil (about ten cents' worth) and set condenser into it. The capacity will be about four times as large as before. The appearance when completed is shown in the drawing.

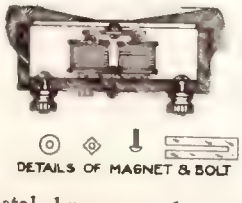
Contributed by

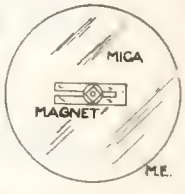
M. McNULTY.

Note.—If a condenser of this type is enclosed in a metal case the capacity will never come down to zero. Even when the movable plates are entirely out from between the fixed plates, the casing forms an intermediate coating, so to speak, between the fixed and movable plates, giving the effect of two condensers in series. This is why the makers form the case of insulating material.—ED.

MICA DIAPHRAGM RECEIVER

It is a well-known fact that the natural qualities of mica used as the vibrating member of talking machines is superior to any





metal known, and can be used equally as well for the diaphragms of telephone receivers by a slight change in the construction of receivers using steel diaphragms.

In making a mica diaphragm receiver the electro magnet cores and yoke are of soft iron, and the steel magnet (sawed out of a piece of sheet steel with a hack saw) is screwed to the center of the vibrating mem-

ber or mica disc by a very small brass screw and nut.

This receiver is very sensitive and can be made in a short time with very few tools.

Contributed by

CHAS. A. WILSON.

A GOOD WAY TO GET BINDING POSTS

Good binding posts can be made from old wet-battery zinc rods by cutting off the top of the zinc as in Fig. 1, ¼ inch to one and a quarter inches long. After this is done,

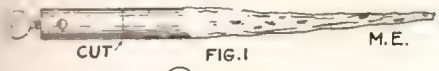


FIG. 1

FIG. 2

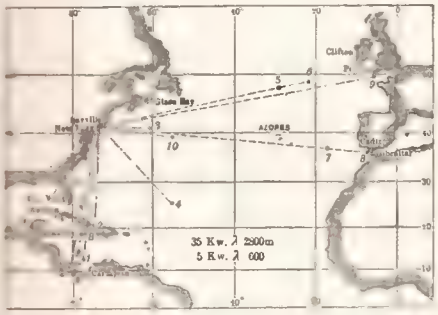
drill a hole in the center of the bottom of the piece, and tap it for a machine screw, and the binding post is complete.

Contributed by

HARRY KIHLSTROM.

RANGE OF WIRELESS COMMUNICATION FROM SAYVILLE, N. Y.

The wireless station established at Sayville, on the southern shore of Long Island, N. Y., by the Telefunken Wireless Telegraph Company of the United States is in daily communication with vessels passing between America and Europe and also to South American ports. The limit of communication shown by the accompanying map is 5,800 km., or to the Straits of Gibraltar. The daily ranges



of communication with several of the ships of the Hamburg-American line are shown on the map. The longest distances are worked with a 35-kw. plant and a wave-length of 2,800 m. The lesser distances are operated with a 5-kw. plant and a wave-length of 600 m. Among the distances shown on the map are the following, all measured from Sayville:

To the steamship *Metapan*, 3,515 km.; to the *Prinz Eitel Friedrich*, 3,500 km.; to the *Parkar*, 920 km.; to the *San Juan*, 2,405 km.; to the *George Washington*, 4,250 km.; to the *Moltke*, 4,600 km.; to the *Berlin*, 5,800 km.; to the *Kaiser Wilhelm der Grosse*, 5,250 km.; to the *Franz Josef I*, 1,480 km.—*Electrical World.*

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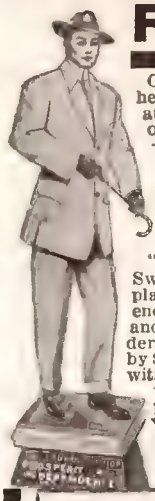

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WIRELESS CONTROLLED BOAT

It has been reported that Mr. John Hays Hammond, Jr., has been experimenting for several months past with a motor boat which may be controlled from his wireless station on shore.

The boat is provided with its own power plant and carries a crew of two or three men, although most of the time they have nothing to do except to keep the power plant in operation and to see that the boat does not run into buoys and other floating objects. The wireless controlling apparatus is so arranged that it can be disconnected at a moment's notice, and the control of the boat then is in the hands of the crew, but the wireless control is capable of causing the boat to start, stop, slow down or speed up, or turn in either direction. It is said that the wireless control is so nearly perfect, and its manipulation by the man on shore is such, that very seldom does the crew of the boat find it necessary to take the control into their own hands.

LAKE TO PACIFIC BY WIRELESS

Winnipeg, Man.—Communication was established recently between the wireless station at Port Arthur, Ont., and Queen Island, which lies north of Victoria, B. C., the operators exchanging congratulations and greetings.

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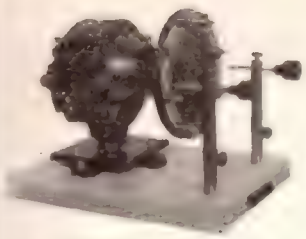

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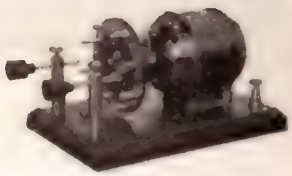

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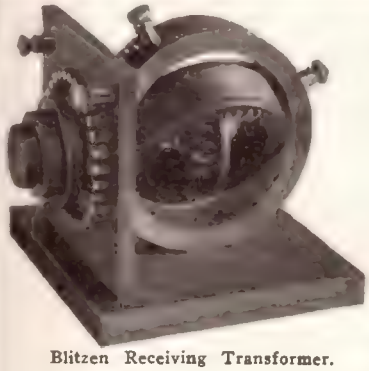

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Under the new Federal Radio Regulation Act your transmitter must give a pure, sharp wave not over 200 meters in length. The *NEW* Clapp-Eastham Hot Wire Meter is the finest instrument we have seen for tuning the transmitter. Price, 5 Amp., $10.00; 10 Amp., $11.00; 15 Amp., $12.00. The *NEW* Clapp-Eastham Wave Meter to be used with your own detector and phones will tell you your own wave length and the wave length of all other stations within range of your instruments. Price, $8.00.

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Precision Hot Wire Meter.

CLAPP-EASTHAM COMPANY

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A. Wedderburn, Pat. Atty., Dept. M., Washington, D. C.

When writing, please mention "Modern Electrics."

Advice on Patents

BINDING POST

(95) Raymond B. Wilson, of Berkeley, Cal., sends in a model of a new binding post, also a sample of the well-known spring binding post, and wishes to know if his model infringes on the Fahnestock post.

A. We are very much afraid the model as sent in by our correspondent infringes. By observing the patent just issued on the Fahnestock post, as printed in this issue, it will be found that they cover almost the identical things which our correspondent claims as new.

TELEPHOT

(96) Ralph Nathan, of New York City, says that he has an idea about a telephot which he thinks is correct theoretically, but he has no means whatever to carry it out. He wants to know if he can get anyone interested in his invention.

A. In a case of this sort, it is very hard to give advice. You must trust somebody and it will be necessary to hunt up someone who has sufficient belief and confidence in you to spend some money to make the research work. You probably know of some manufacturer or some person who might be interested and he is the one to see, although we admit that such a procedure is more or less risky.

BINDING POST

(97) J. P. Jansen, of Newburgh, N. Y., sends in a model of a very clever binding post which is constructed in such a manner that when the wire carrying a special lug is inserted in the post it cannot be withdrawn no matter how hard one pulls. There are several other unique features about this post.

A. We have considered the matter carefully, but have come to the conclusion that on account of the special lug needed and on acount of the intricate parts, such a post would not be a commercial success, unless it could be introduced for automobile work where it is absolutely necessary to keep a good connection at all times. We believe a patent could be obtained on this post.

PHYSICAL APPARATUS

(98) Elvis M. Boss, of Pekin, Ind., has constructed an apparatus to prove that a ball going in an angle and a ball dropping straight down, if they are both dropped at the same time, will strike at the same time. He claims that in the physics class that an argument came up as to prove the well-known assertion, and he constructed an apparatus by means of which the contention is proven conclusively.

He wishes to know if the idea is worth anything.

A. An article of this sort naturally has only a very limited field as only physics departments of educational institutions would be interested in it. We think that there would not be much trouble to secure a patent

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Lincoln National Bank.....Washington, D. C.
Little Giant Hay Press Co., Alma, Mich., and Dallas, Texas
Electro Importing Co.....New York, N. Y.
American Railway Appliance Co.....Oil City, Pa.
Rogers' Mfg. Co.....Norfolk, Virginia
Pacific Mfg. Co.....New York, N. Y.
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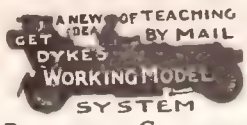

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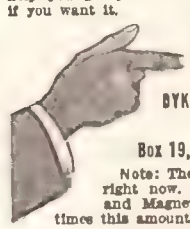

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PATENT SPECIALTY COMPANY
462 Sanchez Street, San Francisco, Cal.

When writing, please mention "Modern Electrics."

on this article, but we have our doubts that it would prove a financial success on account of the limitations in the sales that would be made of such an article.

AUTOMATIC STOP

(99) Geo. B. Schleicher, of Philadelphia, Pa., has invented an automatic stop for use in steam railroads, the idea being to stop a train that passed the danger signals.

Our correspondent wishes to know if the idea is practicable and patentable.

A. We have looked over the description and drawing carefully and have come to the conclusion that there is nothing patentable contained in the description as very similar ideas have been known and patented for quite a while. We believe there are some railroads using the device now.

BINDING POST

(100) Donald W. Davis, of Montrose, Colo., sends in a design of a clever binding post that seems to have some merits.

This binding post takes a wire of No. 0 to No. 40 B. & S. and the best part of it is that it has only two parts which may be made very cheap. By substituting a thumb screw instead of the machine screw, as shown in the correspondent's sketch, we believe that a very good binding post is created. We think a patent can be obtained without much trouble.

If the form of this post is changed to give it a more pleasing appearance, we are almost sure that it will find a good market.

BEST WAVE-LENGTH FOR WIRELESS

(*Continued from page 1281.*)

wave-length consistent with good coupling gives the best result under all conditions, unless the absorption is very much greater than the assumed value, in which case a somewhat longer wave will be better. On increasing the height of the aerial, longer waves will obviously be necessary, but the concomitant increase in power and range will throw the optimum wave-length to a higher value. Experiments are now under way to test these points. The following conclusions were reached: (1) Increase of power displaces the optimum wave-length in the direction of longer waves; (2) increase of height of aerial will also increase the optimum wave-length; (3) inefficient aerials will reduce the optimum wave-length; (4) increased absorption will increase the optimum wave-length. Increased radiation efficiency, as by the use of synchronous rotary spark gap, etc., will increase the optimum wave-length.

Y. M. C. A. RADIO STATION

(*Continued from page 1261.*)

is used in this antenna. Some phenomenal performances in the way of both long-distance sending and receiving are attributable to the high and commanding position of this part of the equipment.—*G. S. Corpe.*

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Is your wave length less than 200 meters? Does your logarithmic decrement exceed two-tenths? Do you know that your wave form meets the requirements? Have you a maximum sending distance with 1 kw. limit?

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Will answer the above and satisfy the government inspectors that you are operating within the law. Send stamp at once for descriptive matter.

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Big chance for factories, shops and experimenters to get a first-class high efficient arc lamp at the above price.

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1024

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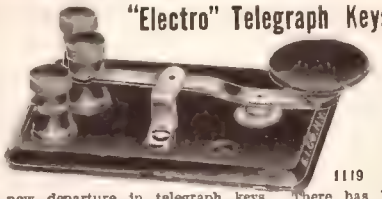
Points of superiority: Hard rubber composition shell and cover beautifully polished. Powerful permanent steel magnet inside, soft iron bobbin core, fibre core heads, very thin diaphragm, brass binding posts inside. Hanger can be unscrewed and receiver will then fit without extra attachments, our No. 8072 and 8073 headbands.

Receiver has single pole; size 2¼ x 1⅛ inches; weight 4 ounces; resistance, 75 ohms. If two of these receivers are used, it is possible to speak at a distance of 150 feet without the use of any batteries, one wire being sufficient if ground is used.

No. 1024 Pony receiver, 75 ohms, as described....**40c.**
Shipping weight 7 ounces.

See Cat. No. 11 for further description.

"Electro" Telegraph Keys


1119

A new departure in telegraph keys. There has long been a demand for good, efficient, but cheap telegraph key and the one which we are now manufacturing complies with all demands that anyone could possibly make of a low price key. Parts are mounted on solid hard rubber composition base, size 2½ x 3½ inches, ¼ inch thick. All metal parts are nickel-plated and polished and the contact arrangement is simple but absolutely sure. A standard telegraph knob one inch in diameter in hard rubber composition is furnished. The No. 1118 Key has two of our standard rubber binding posts, while the No. 1119 has three of them. This key works easily and there is nothing to get out of order. It will make a handsome addition to any instrument table.

No. 1118 Single Circuit "Electro" Telegraph Key, as described.....**25c.**
No. 1119 Double Circuit (Morse) "Electro" Telegraph Key composition base, as described.....**30c.**
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This is the wire for you to get. It solves your most difficult aerial problems. If you wish to see your aerial "stay put," use our cable, and your troubles are over. Our 2509 wire measure .077 in. diameter, and the weight is 1¾ pounds per hundred feet.

The No. 2510 wire measures .060 in. diameter, weight per hundred feet is 16 ounces.
The No. 2509 has seven strands No. 22 B. & S. wire, while the No. 2510 has 4 strands No. 22 B. & S. wire.

We are introducing the smaller size for general amateur stations on account of its cheapness. See our Cat. No. 11 for further description.

No. 2510 4 stranded cable per hundred feet—**45c.**; thousand feet lots—**$4.00.**
No. 2509 7 stranded cable per hundred feet—**75c.**; thousand feet lots—**$7.00.**
See Cat. No. 11 for further description.

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No. 34 B. & S. enameled wire per pound **70c.**; Regular Price $1.75
No. 35 B. & S. enameled wire per pound **80c.**; Regular Price $1.86
No. 36 B. & S. enameled wire per pound **90c.**; Regular Price..... $2.12
Shipping weight (including spool and packing) per lb., 20 ozs.

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The original supply amounted to over one thousand of each different style, but they have been sold so rapidly that only a few of each style now remain. In order to close out these few promptly, we will dispose of them at the almost inconceivable prices below, which represent actual cost to us; or in other words, 37 per cent. below original manufactured cost.

Please note we give below the only styles left and the correct number in stock at present.

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Style C.	6 in. high, 5 in. wide, 5½ in. long, mahogany (in stock 24)	Price,	30c.	" "	2 "
Style D.	10 in. high, 6 in. wide, 5¾ in. long, mahogany (in stock 53)	Price,	40c.	" "	4 "
Style E.	7 in. high, 5⅛ in. wide, 6⅝ in. long, mahogany (in stock 49)	Price,	50c.	" "	3 "

Take advantage of this opportunity before it is gone.

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1919 1920

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No. 1919 Binding Post, each..... $0.05
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Shipping weight, per dozen..... 5 oz.

No. 1920 Binding Post, each..... $0.05
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Shipping weight, per dozen..... 5 oz.

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This wonderful alloy is in a class by itself and has properties not shared by any other metal or alloy. It must not be confounded with the so-called Woods metal, which, melting at about 158° Fahrenheit, cannot be handled by hand, being too hot at such temperature, and solidifying too rapidly.

For mounting crystals, minerals, etc., **Hugonium Alloy** is unsurpassed, and the crystals retain their full sensitiveness, it not being necessary to use excessive heat to make the alloy pliable as in the cases of Woods metal and other alloys. Heat in most cases kills the mineral for all practical purposes.

ORDINARY ACID DOES NOT ATTACK HUGONIUM ALLOY

DIRECTIONS FOR USING THE HUGONIUM ALLOY.

Place bottle containing the alloy in hot water (not necessarily boiling) for about one or two minutes. This liquefies the metal entirely. It can now be poured in the warm hand and kneaded like wax. It is to be recommended to have everything in readiness, as the metal solidifies in 30 to 40 seconds becoming as hard as copper.

No. 9028—Hugonium Alloy,
per bottle of 1 oz. net.. **30c.** Shipping weight 3 ozs.
In lb. lots..... **$4.00.**

Tin Foils

We carry the largest tin foil stock in New York. We have different thicknesses of tin foil listed below. For small paper condensers we recommend our No. 4335. The different qualities listed are imported by us and are warranted to be of the best make. The No. 6251 is fairly thick and is suitable for small leyden jars and plate condensers. Our No. 6252 is intended for very heavy work, large capacity condensers up to 5 K. W.

Cat. No.	Thickness	No. sq. in. to lb.	Remarks	Price per lb.
4335	Thin	1728	Suitable for paper condensers	$0.25
6251	Medium	1000	For small leyden jars	.20
6252	Heavy	600	For large transmitting condensers	.35

Typewriter Knob

6013

This beautiful molded hard rubber composition knob may be used for a great variety of purposes, such as variable condenser handles, variometer handles, spark gap handles, rotary switch or rheostat handles, and other uses. The dimensions are: Diameter of knurled head, 1½ in.; length of sleeve, about 7/16 in.; diameter of sleeve, 3/18 in.; diameter of hole in sleeve, ¼ in. A 6-32 screw holds the metal rod in place when in the hole of the sleeve. Shank is nickel plated.

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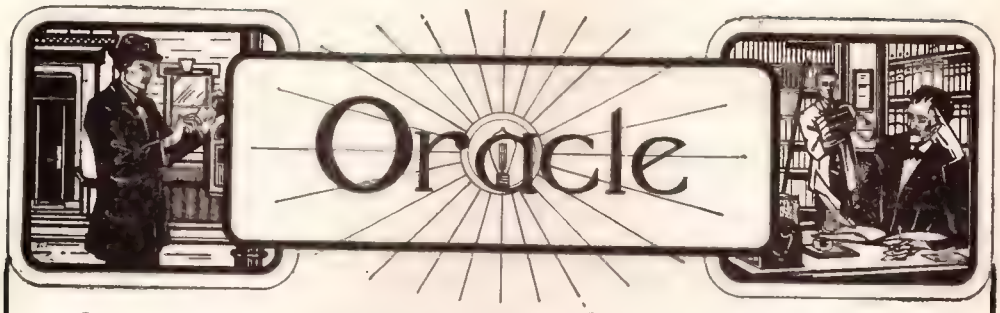


Queries and questions pertaining to the electrical arts, addressed to this department, will be published free of charge. Only answers to inquiries of general interest will be published here for the benefit of all readers.

On account of the large amount of inquiries received, it may not be possible to print all the answers in any one issue, as each has to take its turn. Correspondents should bear this in mind when writing.

Common questions will be answered by mail if 10 cents to cover expenses have been enclosed for each question. This class of correspondence has grown to such proportions that we can no longer answer questions by mail free of charge.

Owing to the additional labor required in the gradual advance of the date of publication of this magazine, there will be more or less delay necessary in answering questions and we therefore cannot undertake to furnish quick replies, for the next few months at least.

Special information requiring a large amount of calculation and labor cannot be furnished without remuneration. THE ORACLE has no fixed rate for such work, but will inform the correspondent promptly as to the charges involved.

NAME AND ADDRESS MUST ALWAYS BE GIVEN IN ALL LETTERS. WHEN WRITING ONLY ONE SIDE OF QUESTION SHEET MUST BE USED; DIAGRAMS AND DRAWINGS MUST INVARIABLY BE ON A SEPARATE SHEET. NOT MORE THAN THREE QUESTIONS MUST BE ASKED, NOR SHALL THE ORACLE ANSWER MORE THAN THIS NUMBER. NO ATTENTION PAID TO LETTERS NOT OBSERVING ABOVE RULES.

WE CANNOT ANSWER QUESTIONS REGARDING SENDING AND RECEIVING RANGES.

PLEASE NOTE

We frequently receive questions for the Oracle accompanied by the request, Please do not refer me to back numbers as I have only a few. In order to comply with requests of this sort, it would be necessary to repeat over and over again in this column information that had already appeared either here or in the body of the magazine, and this the Oracle has no intention of doing. If you do not happen to have a back number referred to you can probably borrow it from a friend or in the event that you cannot get hold of it in any other way, we can probably supply you with a copy.

TOY RAILROAD

(2322.) Richard Gless, New York, writes:

Q. 1.—I have a trolley line rigged up in my house, and finding that batteries are too expensive, I thought I would write to you for assistance. The car is manufactured by the Lionel Mfg. Co., and is of the pay-as-you-enter type, and weighs about 1½ to 2 pounds with motor and body together. This is supposed to run on 6 to 7 volts either A. C. or D. C. Kindly tell me how to build a dynamo at low cost but still large enough to generate 6 to 8 volts, or would it be cheaper to buy one ready made?

A. 1.—You might better buy the dynamo than attempt to make it.

Q. 2.—Which would run it best, a toy steam engine or battery motor, or by the water power?

A. 2.—The water motor would be most suitable if the pressure is 30 pounds or over.

CAN'T SEND FAR

(2323) Thomas H. Elliott, Jr., Massachusetts, asks:

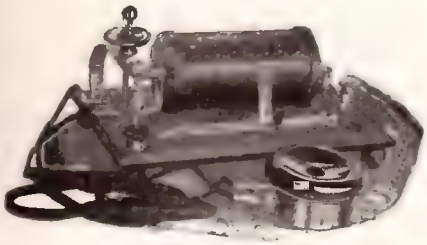
Q. Will you kindly tell me what is wrong as far as you can make out, with my sending set? It consists of the following: ½-kw. Blitzen transformer, 35 plate glass condenser in oil, helix, spark-gap and key. I can't send more than 5 or 6 miles. My aerial is 90 feet long, 60 feet high at one end and 55 feet at low end. My lead-in is 35 feet long. I have three grounds, one in a brook in the rear of the house, a pipe driven into the ground and a water pipe.

A. It may be that the sending condenser is too large or too small. Your set may not be properly tuned, but the trouble is probably with your ground connection. Instead of driving pipes into the ground, you might better bury a number of metal plates sufficiently far below the surface to insure their being surrounded by damp earth at all times. These plates should have a total area of from 50 to 100 square feet and should be buried some distance apart from each other and should be connected to the station ground by means of fairly heavy copper wire, soldered to the plates. The material composing these plates does not make any great difference, and if metal plates are not available, junk metal may be used instead, so long as the area in contact with the ground is the same. Another method of making a good ground is to bury from 500 to 1,000 feet of wire in trenches two or more feet deep, radiating in all directions from the station in the form of a fan. This latter method is the one employed at the new naval station at Arlington, where something like 60,000 feet of wire is used for the ground connection.

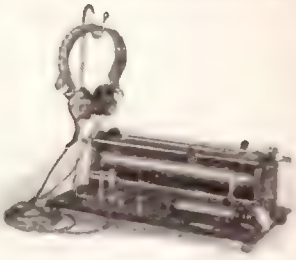
You Need Our Bulletin M

Whether you own a wireless station or contemplate getting one, you should be posted on the latest, most compact and highest efficient outfits on the market at prices lower than you ever heard of before. Get posted

SEND FOR BULLETIN M TO-DAY



No. 797 Receiving Set
Comptete witb Aerial
Special Price
$1.95



No. 1801 Receiving Set
Three Slide, 13" Tuner, Fixed Condenser, Detector, 150 Ohm Receivers and Headband
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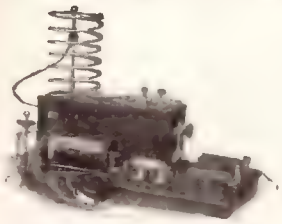

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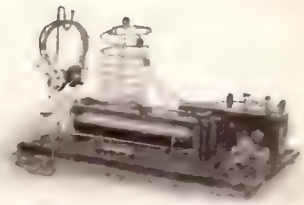
1000 Ohm Receiver
$8.95



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2000 Ohm Receivers and Headband
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COLUMBIA IGNITOR

Best By Test Get The Best

NATIONAL CARBON CO.

CLEVELAND, O.

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TUNING RANGE

(2324) W. B. Neumann, New York, asks:

Q. 1. Please give me the lowest and highest wave length I can tune with an aerial 94 feet long, 2 wires 5 feet apart and 115 feet high at one end and 110 feet at the other, lead from the lower end 25 feet, ground 20 feet. E. I. Junior tuner, loading coil 6 inches diameter; 6 inches high No. 24 wire, a small fixed condenser?

A. 1. It is impossible to answer questions of this sort exactly, but you can probably tune to wave lengths of from 200 to 2,000 metres.

Q. 2. Could I receive from Arlington with the above set, also MCC?

A. 2. You can probably receive from MCC, but not from Arlington, for the reason that the Arlington Station uses a wave length of about 4,000 metres.

Q. 3. I applied for a license for my station about a month ago, and, after filling out several blanks, I got an acknowledgement of my application, stating that it will be considered in its turn. Does this mean that I have nothing more to do with it, or what must I do?

A. 3. If you have changed your station to conform to the law as far as you are able to, you have nothing more to do until the radio inspector visits your station.

THEORY OF DETECTORS. POLARIZED RELAY

(2325) E. Benton, Wisconsin, inquires:

Q. 1. Please explain the way minerals work, or what is the theory of operation? How does the electrolytic detectic work? This information is to be used in connection with the study of wireless in physics classes in the High School here. Up to now a coherer has been used, but the professor wishes to be up to date and use a detector.

A. 1. The electrolytic detector and practically all crystal detectors act as rectifiers, which transform the high frequency alternating current set up in the receiving circuit by the incoming waves into pulsating unidirectional current, which is passed through the telephone receivers to render the signals audible. For a more detailed discussion of the theory of detectors we refer you to Pierce's book on the Principles of Wireless Telegraphy.

Q. 2. Does it make any difference which pole, North or South, the electro magnets are mounted on, on a polarized relay?

A. 2. No.

CHARGING STORAGE BATTERIES

(2326) Kenneth Lohman, California, writes:

Q. 1. I have a dynamo which gives 15 volts and 25 amperes direct current. How many 2-volt, 10-ampere-hour storage batteries can I charge at once with this?

A. 1. Theoretically, you may charge 120 such cells from this dynamo in eight hours, the cells taking eight hours to charge, which is the usual time allowed for batteries of the lead and acid type.

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The new Thordarson Junior Bell Ringing Transformer represents the height of perfection and embodies all the essentials of a perfect design electrically, magnetically and mechanically. Weight and size reduced to a minimum—highest efficiency guaranteed—consumes no current—strongly endorsed by the National Board of Fire Underwriters.

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Push Button and Wire that retails for $2.00, packed in box, 35c. extra.

A Good Horn at a Low Price, Black Enamel very High Gloss, Weighs Two Pounds and a Half; Consumes very little current (1½ to 2½ amperes), Emits High Toned Musical Blast, Has no Parts to get out of order, Has no *Vibrator*, the Diaphragm is the Armature, Requires No *Oil*. Runs on *Six Volt* Battery, Gets better with age as the "Bulging" of the diaphragm which is detrimental to other horns, makes the **"CUBIT"** more efficient.

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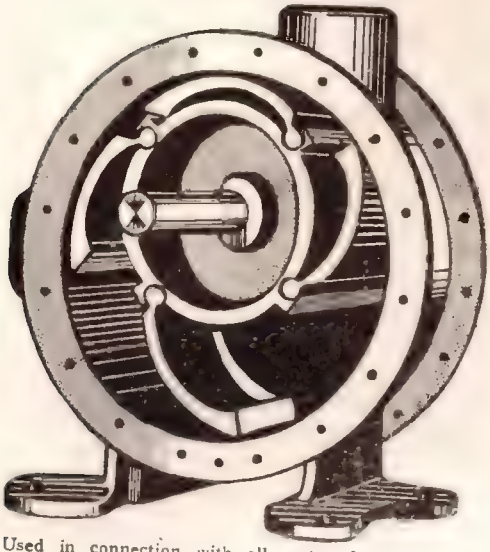
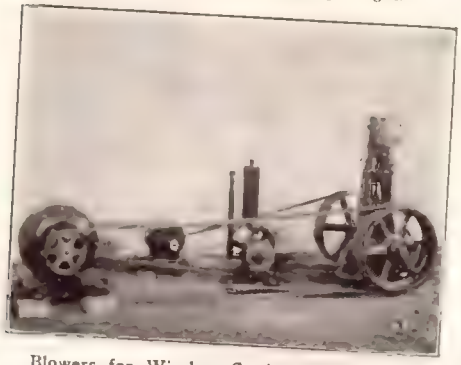


Used in connection with all sorts of gas and oil furnaces, blow pipes and appliances, gas producers, testing mains and meters, sand blasting, agitating liquids, blowing chips and particles from machines, drills, presses and other tools as well as for vacuum cleaning on small or large outfits. Very powerful, simply constructed. Can't get out of order. 1 oz. to 10 lbs. pressure; 1 to 20 inches vacuum; capacities 2 to 338 cubic feet per minute.

The only *vacuum pumps and pressure blowers* that take up their own wear. The centrifugal force holds the wings against the cylinder without the use of springs. A high, positive and steady pressure and vacuum without fluctuation is the result. The wings and cylinder are the only moving parts and these are large and strong. These machines are adapted for experimental work and we have them as small as two cubic feet per minute. Also made gas tight.



Blowers for Wireless Station Power Plants.

Can be used in connection with plain spark gap to clear gap of metallic vapor, etc.; also ventilates casing of rotary spark gap either by pressure or vacuum; increases resistance and quenching of rotary spark gap by raising pressure in spark chamber, and is also used by wireless companies for cooling Quenched Gaps. Guaranteed to increase efficiency of the gap in each of the foregoing cases.

We will gladly send free on request to those interested, *Catalogue No. 138* descriptive of *Blowers* or *Catalogue No. 139* illustrating and describing *Vacuum Pumps.*

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When writing, please mention "Modern Electrics."

Q. 2. Should the batteries be connected in series or multiple?

A. 2. The batteries should be connected in series multiple, there being twenty groups connected in multiple, each group consisting of 6 cells in series.

Q. 3. If I charge one of the above batteries with 10 amperes, should it take one hour to charge it?

A. 3. Yes; but you will probably ruin the battery. The charging current should not exceed 1.25 amperes per cell, which will require eight hours.

RECEIVING SET WILL NOT WORK

(2327) Carl Sellors, of Pennsylvania, writes:

Q. I enclose herewith a rough sketch of a hook-up that I have been unable to get any satisfactory results from. Could you suggest any causes for the failure of this set to receive?

A. Your hook-up appears to be O. K. Probably the fault is with the ground connection. See answer to No. 2323, in this issue. Also the difficulty may be due in some measure to the fact that your apparatus may not be properly adjusted.

TESLA COIL

(2328) Marvin Mottashed, Iowa, writes:

Q. 1. I have a Tesla coil secondary, 4 inches diameter, 14 inches long, wound with 150 turns No. 34 SSC wire spaced ⅛ inch apart, primary 8 turns No. 8 bare copper wire spaced ¾ inch apart on a frame 6 inches diameter. With 1-inch spark coil run by six dry cells, a 1½-pint leyden jar, zinc spark-gap, I get a 1-inch spark. Is this all right, or should I get a longer spark?

A. 1. You are probably getting as long a spark as you should expect from the outfit.

Q. 2. Could I increase the spark length by winding the secondary wire closer together?

A. 2. Yes. If you put more wire on the secondary.

Q. 3. Is the leyden jar the right size, or should I get a quart one?

A. 3. Probably your leyden jar is big enough, and we would not advise the purchase of a larger one for use with your coil.

HIGH FREQUENCY GENERATORS

(2329) A. Radom, Connecticut, wants to know:

Q. 1. Where can I get Climax resistance wire for hot-wire instruments?

A. 1. This wire may be obtained from the Driver-Harris Wire Co., Harrison, N. J.

Q. 2. The Alexanderson high frequency generator is about the only one that will give sine waves steadily. Would an instrument that generates very high frequency waves like the Poulsen arc, but generates them steadily like the Alexanderson's alternator supersede both of them commercially?

A. 1. This whole thing depends upon the efficiency and reliability of the generator, as well as its output. If a machine can be developed which will be better in this re-

You Can Vary the Tone or Pitch of Your Spark

at will by using the

BARNES VARIABLE SPEED A. C. MOTOR

on your revolving spark gap.

Made in two sizes suitable for direct connection to any gap from ¼ K.W. to 5 K.W., or larger, and instantly variable in speed from 2,000 to 7,000 revolutions per minute without the use of external resistance or other regulating devices. Absolutely reliable and positively non-heating. High efficiency at *all* speeds.

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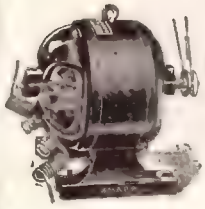

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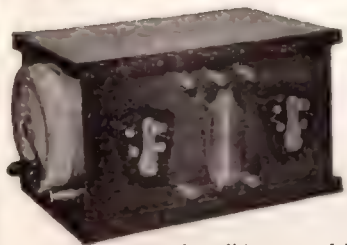

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spect than the Alexanderson alternator or the Poulsen converter, it will be used in preference to them.

Q. 3. The foremost types of wireless telephone transmitters with the current each can carry, and if there are any regular commercial wireless 'phone stations either in Europe or America?

A. 3. There is no data available on this subject at present, as there are no commercial wireless telephone systems in use at the present time.

PERIKON DETECTOR. WIRELESS CALLS

(2330) Clifford Vick, Texas, would like to know:

Q. 1. What two minerals is it that make a "Perikon" set, and which is the point?

A. 1. Zincite and Chalcopyrite. The latter is used as the point.

Q. 2. What are the calls of the following stations: At Glace Bay; Arlington, Va.; Eiffel Tower, France.

A. 2. MGB, NAV, FL.

Q. 3. What is the distance that a 1-kw. transformer is ordinarily heard?

A. 3. This depends upon a number of conditions, and may be anything from 50 to 1,000 miles. In all probability, however, the distance would be more nearly 50 than 1,000.

UNDERWRITERS GROUND SWITCH

(2331) John Schultze, New York, asks:

Q. 1. Would it be in accordance with the Fire Underwriters Rules to make a 100-ampe e switch with an oak base 2 inches thick?

A. 1. No. The base must be made of some non-absorbent, non-combustible material. In other words, the material must not soak up water and must not burn.

Q. 2. Also let me know of what material I should make the switch, and its size?

A. 2. The metal parts should be made of copper, and the base should be made of some material, such as porcelain or the va.ious current-carrying parts may be mounted by means of porcelain insulators on a metal base. The dimensions of the blades and jaws are given in answer to No. 2296, in the February issue.

TUNING COIL

(2332) J. Verner Harold, Pennsylvania, writes:

Q. 1. I am making a tuning coil and would like you to give me some pointers in regard to its construction. It is to be 15 inches long and to have 14 inches of winding space. tube to be hollow and 4-inch outside diameter, wound with No. 22 black enamel wire. I want to take 14 taps at a space of 1 inch apart to a regulating switch mounted on one end of the coil. I intend to put two sliders on coil and have four binding posts, one on each end of each slider rod. When I take taps from the wire the beginning or first end of the wire goes to the first pin, and the last end of the wire goes to the switch handle, does it not? Please suggest a better scheme. Which would be best—to have the 14 taps going to one end, or to take 28 taps, ½ inch apart and

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take 14 to each end. If the latter, would alternate wires go to each end or would the first 14 go to the first end and the second 14 go to the second end? Which scheme is best?

A. 1. No. This arrangement would short circuit part of the winding depending upon which contact the switch arm happened to be resting. As long as you use any sliders, you might better put on three instead of two and cut out the switch arrangement, as it seems to be of no advantage. If you still think, however, that you want it, take a tap in the winding every half inch and bring those nearest one end out at that end and do the same at the other end, providing a sufficient number of contacts on each end of the coil. Then connect the two switch levers together and to a binding post and have a blank contact point at each end of the coil and see that one or the other of the two switch levers always rests on one of these blank contacts in order to avoid short circuiting part of the winding. One end of the circuit connected to the coil through the switch arrangement should be made through the binding post connected to the switch lever, the other end of the circuit connected to either end of the coil winding.

Q. 2. I calculate that it would take about 500 feet of No. 22 black enameled wire to wind this tuning coil. Am I right?

A. 2. Yes. Assuming thirty-six turns to the inch, the coil would require 530 feet of wire.

Q. 3. Where can I procure a suitable tube of card or pasteboard of these dimensions, 15 inches long and 4 inches outside diameter?

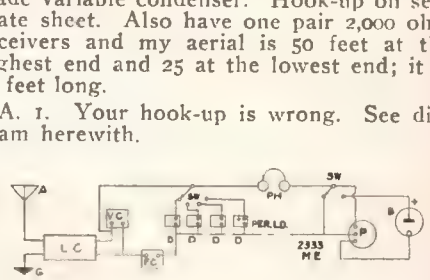
A. 3. Try the Dennison Mfg. Co., 15 John Street, New York, N. Y., or make the tube up yourself from brown paper and shellac. It is not a hard job.

RECEIVING SET

(2333) Charles Aubert, New Jersey, asks:

Q. 1. What should be added to my set to increase its receiving range? I have the following: One loose coupler (Arnold make), 4 detectors, silicon, Perikon, Peroxide of Lead and molybdenite, one home made variable condenser. Hook-up on separate sheet. Also have one pair 2,000 ohm receivers and my aerial is 50 feet at the highest end and 25 at the lowest end; it is 75 feet long.

A. 1. Your hook-up is wrong. See diagram herewith.



Q. 2. If I need any other apparatus please give diagram with that apparatus in it?

A. 2. You need in addition a small fixed condenser of about 0.003 mfd. capacity. This is shown in the diagram.

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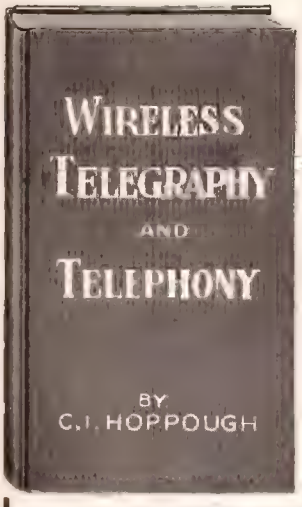

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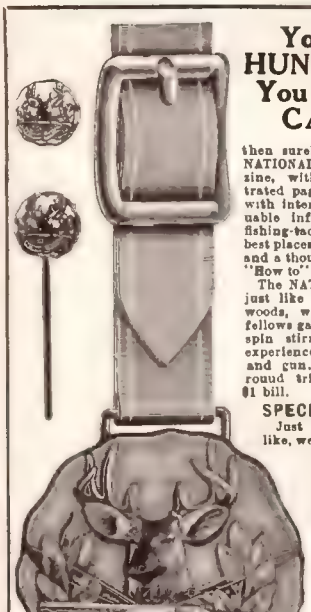

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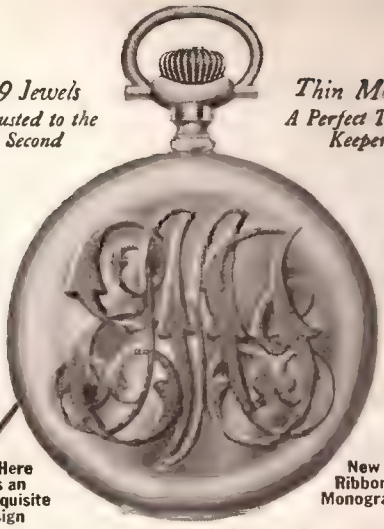

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RECEIVING SET. TRANSFORMER RATING

(2334) DeWitt Holder, Jr., Mississippi, writes:

Q. 1. I have an aerial about 200 feet long and 40 feet high, two No. 14 aluminum wires spaced four feet apart, and E. I. Co. new loose coupler, E. I. Co. 2,000 ohm, transatlantic type receivers, condenser and Galena detector, water pipe ground. I cannot hear anything but static. Would a loading coil in the aerial circuit help any; if not, what would?

A. 1. No. Your ground is poor unless the pipe forms part of the city water supply system. In addition there may be something wrong with the adjustment and hook-up of your apparatus.

Q. 2. What is the difference in the output of a 500 watt coil and a ½ kw. transformer?

A. 2. This depends on the efficiency of the two. Coils usually have an efficiency of about 50%, open core transformers, 60% and closed core transformers 80% to 90%.

Q. 3. Where can I get the primary of a 1 in. sealed in coil rewound?

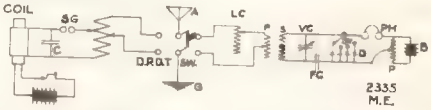
A. 3. We would advise you to take this matter up with the manufacturer of the coil.

WRONG HOOK-UP

(2335) Charles Hewitt, New York, asks:

Q. 1. Will you kindly tell me if the enclosed hook-up is all right and if it is not tell me how to rewire it so it will be all right?

A. 1. Your hook-up is not correct. See diagram herewith.



Q. 2. Will an oscillation transformer work on a two inch E. I. Co. coil?

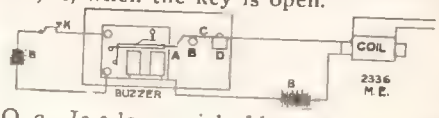
A. 2. Yes.

BUZZER INTERRUPTER. LOW VS. HIGH AERIALS

(2336) W. F. Harper, Canada, wants to know:

Q. 1. Is there any way of using an electric buzzer as a circuit breaker in a spark coil? In what way?

A. 1. Yes. See diagram herewith. This interrupter simply consists of an ordinary buzzer screwed to a board, the armature having a short extension in the shape of a flat piece of spring brass or a piece of heavy brass wire attached to the free end. Also mounted on the same board with the buzzer is a stiff spring, C, fastened to a support, D, and resting against screw, B. The spring, C, should be so adjusted that it just does not touch the extension of the armature at point, A, when the key is open.



Q. 2. Is a low aerial of large area as good as a small aerial at a great height?

A. 2. This depends to a great extent on surrounding conditions. If the aerial is to be erected in a flat, open country, probably

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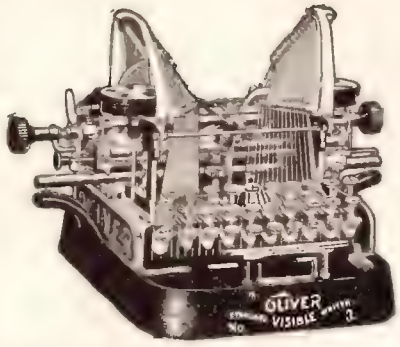

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the low aerial of large area would be better than the small high aerial, while if the country is hilly or the aerial is surrounded by trees or other obstructions, then the high aerial will give better results.

Q. 3. I am making a two slide tuner 12 inches long and 3 inches diameter wound with No. 20 enamel wire. What other instruments would I need to receive up to 1,000 miles?

A. 3. You will need a small fixed condenser of about 0.003 mfd. capacity, a sensitive detector and a good high grade pair of head receivers.

GROUND WIRE. SLI

(2337) W. N. Ivey, Pennsylvania, asks:

Q. 1. Will two wires both joining the same points answer the same purpose as one wire twice the size of either of the small wires? (As the law requires a No. 4 ground wire, would two No. 8 wires serve the purpose?)

A. 1. Two No. 6 wires connected in parallel would be satisfactory, but two No. 8 wires are too small, as they are not equivalent in carrying capacity to one No. 4 wire.

Q. 2. Is it true that by passing an electric current through an old worn out piece of silicon the sensitive parts will be brought to the surface?

A. 2. So far as we know, this is not true.

Q. 3. Is SLI (on Long Island) a Government or Commercial station? When was it installed? What is its wave length and power? What is its purpose?

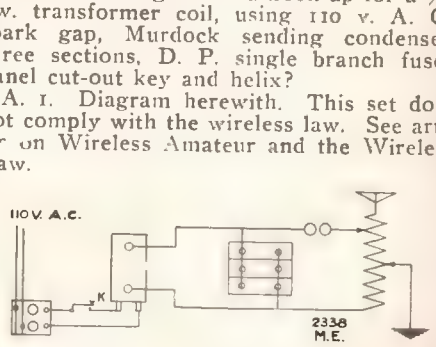
A. 3. The station SLI is a commercial station owned by the Atlantic Communication Co., which is reputed to be associated with the Telefunken Co., of Germany. It was installed for the purpose of carrying on trans-Atlantic and local wireless business, the trans-Atlantic business being handled directly through the station at Nauen, Germany. The station contains two sets, one reputed to be of 5 kw. capacity, which operates on 600 metres wave length, and the other, said to be 35 kw., which operates on 2,800 metres. The station has been in operation only a few months.

HOOK-UP. GROUND

(2338) Glenn Howe Joseph, Illinois, writes:

Q. 1. Please give me a hook-up for a ½-kw. transformer coil, using 110 v. A. C., spark gap, Murdock sending condenser, three sections, D. P. single branch fused panel cut-out key and helix?

A. 1. Diagram herewith. This set does not comply with the wireless law. See article on Wireless Amateur and the Wireless Law.



Q. 2. Could I send 22 miles with this set?

A. 2. Possibly you might. See notice at head of this column.

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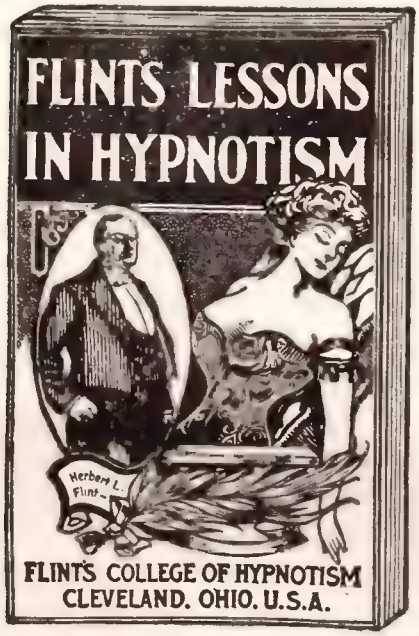

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Q. 3. I have no good place to fix my ground. The nearest water pipe to my set is 35 feet across the house. Would a piece of pipe 10 feet long buried 2 feet deep and connected to the instruments be better than fixing it to the water pipe?

A. 3. No. Run a heavy ground wire to the water pipe, using wire at least equal to No. 8 B & S.

LICENSE. INDOOR AERIAL

(2339) Saverio Lowern, New York, asks:

Q. 1. Do I need a license for a small sending station, consisting of a key and a ¼-inch spark coil?

A. 1. Probably. You had better write to Mr. W. D. Terrell, Radio Inspector, Custom House, New York, N. Y., and find out definitely.

Q. 2 Can you tell me if I can receive with an aerial inside the house, about 36 feet long, in the attic? The house is about 85 feet high.

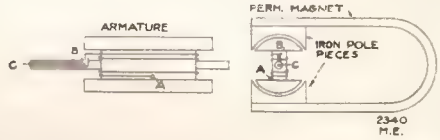
A. 2. Not if it is under a tin roof, especially if the roof is grounded through leaders or rain spouts.

MAGNETO CONNECTIONS

(2340) Fred C. Klune, Jr., New Jersey, would like to know:

Q. Would you kindly give me a diagram of the connections in a telephone magneto?

A. See diagram herewith. One end of the armature winding is connected directly to the core, the other end being connected to an insulated pin which extends out through the end of the shaft. The outside connections are made with the frame of the magneto and a spring which bears on the insulated pin through the end of the shaft.



RECEIVING RANGE. TREES SURROUND AERIAL

(2341) F. P. Gilbert, Massachusetts, writes:

Q. 1. With a set which consists of a 3-slide tuner, silicon detector, fixed condenser and two 2000-ohm receivers and an aerial 40 feet high at both ends and 70 feet long, will I be able to hear 1,000 miles? If I can't, will you please tell me what must be added to the set?

A. 1. You might, under good conditions. See notice at the head of this column.

Q. 2. If I have elm trees and pine trees around me and about 30 feet higher than my aerial, will they effect the receiving distance when the trees are green, and will they when the trees are dormant?

A. 2. Treees surrounding an aerial always decrease its effectiveness, but the effect is less in cold weather, when the trees are dry.

NOISE IN RECEIVERS. LICENSE

(2342) H. P. Jellison, Maine, writes:

Q. 1. On January 3rd, I sat down to listen

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at my wireless at about 10 o'clock at night. When I put the receivers on I heard a humming noise with the switch open. I use a double-slide tuner, and this cuts out all noise due to high tension lines, but it did not stop this noise. I closed the switch, and the noise became louder. I placed the receiver tips on the switch and the noise became deafening. It was not like static accompanied by a thunder shower, which comes at every flash, but was steady. The wind was blowing very heavy outside. One peculiar thing I noticed was when I held one tip in my hand and touched the other to the aerial I heard it fairly loud, but when I touched it to the ground it was as loud as ever. I decided to try a few experiments. I went to the sink and held the tip to the water pipe and still heard the noise. Then I touched the stove, but it was not quite so loud. I could touch anv piece of metal and hear the noise. The smaller the piece, the less the noise. Can yau explain how and where it comes from? It is simple enough to understand where the noise comes from during a thunder shower which is within a few miles of you in the summer time, as each flash makes a noise in the receivers. How do things right within the house, and small at that, become charged? It does not act like static which would come from an insulated body, and come suddenly and then be all over with. It continues steadily with a noise similar to that from high tension lines, only louder.

A. 1. If you have lighting current in your house, the noise is possibly due to some change or derangement in wiring or fixtures, or if the service is alternating current, it may be that due to a cross between the primary and secondary winding of the lighting transformer the high tension current is coming in on your wiring. If none of these is the case, we do not know what the trouble is due to.

Q. 2. If a person lives in the middle of the State, about 25 miles from a Government station, which is the nearest high powered station, can he use a sending set without a license, if he does not use power enough to send more than 5 or 6 miles? He would not be able to send to any high power station, even if he had a long wave length, as his power would be too small. From other magazines, I understand that you can have a set without a license if it is not powerful enough to send across the State boundary.

A. 2. The law is perfectly clear on this point. If you can send across the State boundary line or the coast line, you need a license. If you can interfere with any other station receiving messages from across the boundary you need a license. If you cannot do either of these you do not need a license. See article on the Wireless Amateur and the Wireless Law, in the December and January issues of *Modern Electrics*.

MERCURY ARC RECTIFIER

(2343) Wm. McPherson, Missouri, would like to know:

Q. How does a mercury arc rectifier

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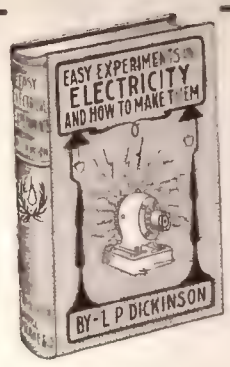

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change the alternating current to direct current?

A. See page 808 in the November issue of *Modern Electrics*.

AUTOMOBILE COILS IN SERIES

(2344) Donald Brown, Canada, writes:

Q. 1. My friend and I both have aerials 25 feet high and 40 feet long, composed of four aluminum wires 1½ feet apart. What size coil would he need using the leyden jar off an Electro Importing Company static machine for condenser to send to me, one mile? My receiving apparatus consists of silicon detector, rheostat, 1000-ohm receiver and 5-mfd. condenser.

A. 1. You could hardly expect to do this with such a sending set and your receiving set.

Q. 2. How could two ⅜-inch automobile coils be connected to give a ¾-inch spark?

A. 2. If the coils each have two secondary binding posts and two primary binding posts, connect the primaries in series and the secondaries in series, being sure that the two secondaries do not buck each other. Then screw down one of the vibrators so that it cannot operate. The spark length should then be more than ⅜ inch, but may not be ¾ inch. If the coils have only three binding posts, one of the posts being common to both primary and secondary, you cannot operate the coils in series.

OHM'S LAW. MAGNETIC DETECTOR

(2345) Edward Werner, California, asks:

Q. 1. If not of too extended a character, kindly furnish me with a complete description of algebraic ohm's law and examples of its practice?

A. 1. Most any elementary book on electricity and magnetism treats on this subject, and you can probably obtain such a book at your public library. We would recommend that you consult such a book, as the subject will be treated in more detail than we could give space to here.

Q. 2. The difference between 1, 2 and 3 phase motors, also the uses of each?

A. 2. The difference between 1, 2 and 3 phase motors is principally in the winding, and the fact that in the case of induction motors the 2 and 3 phase types will start under full load, while the single-phase type must usually be started without load, the load being afterward applied through the medium of a friction clutch or shifting the belt from a loose pulley to a tight one. For detailed description of the various types, we refer you to any book on alternating current motors, which you can probably also find in your public library, as this subject is likewise too long to be treated here.

Q. 3. Please explain the principles and operation of a Marconi magnetic detector.

A. 3. The action of the Marconi magnetic detector depends on a disturbance of the magnetic condition of a continuous moving band of fine iron insulated wires passing through a coil of wire connected to the telephone receivers. Inside this coil is another, through which the band also passes, and which is connected to either aerial and ground directly, in the case of an

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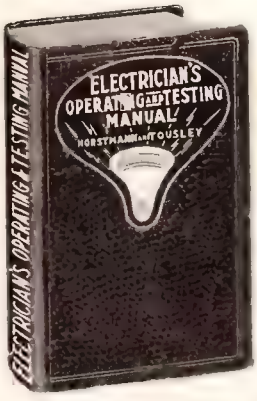

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untuned circuit, or to the detector terminals of a tuned set. For a detailed discussion of the theory of this detector, we refer you to Pierce's book, Principles of Wireless Telegraphy, or any other good book on this subject.

PHONE CONDENSER

(2346) William L. Kindt, Pennsylvania, writes:

Q. State the size and how much of each material should be used to make the most efficient fixed condenser, to be connected across a pair of receivers, each having a resistance of 15 or 16 ohms?

A. It is the experience of the editor of this column that it is inadvisable to use a condenser across the terminals of the head receivers unless the detector used is one requiring no batteries. In this case the receivers may be connected across the fixed condenser in the detector circuit with good results. Usually the set works better under these conditions than where the receivers are connected across the detector. A suitable condenser for use in the detector circuit consists of about 10 square inches of paraffined paper, 0.001 to 0.002 inch thick and placed between tinfoil sheets in the ordinary manner. The size of the sheets makes no difference, and may be any size which is convenient.

AERIAL. TUNING COIL. TRANSMITTING

(2347) Kenneth Beckett, Ohio, writes:

Q. 1. I am going to construct an aerial 60 feet high at one end and 35 feet at the other, and 90 feet long. Would this make a good aerial for long distance work? It is to be of four strands of aluminum wire spaced 1½ feet apart.

A. 1. This aerial should be O. K. if used with a good receiving set.

Q. 2. My tuning coil is 12 inches long and 2½ inches in diameter, and is wound with No. 22 enamel wire. How many meters will this coil tune to?

A. 2. Probably 1,000 metres with your aerial.

Q. 3. Please give instruments that can be used with a 2-inch coil and that will comply with the law.

A. 3. A leyden jar or plate condenser, a rotory or quenched spark gap, and an oscillation transformer. The rotary gap should have no plugs or points on the revolving wheel unless some such device as is described on page 1062 of the January issue of *Modern Electrics* is used. See article on Wireless Amateur and the Wireless Law in the December and January issues.

AERIAL WAVE LENGTH

(2348) Harold Bryson, New Jersey, asks:

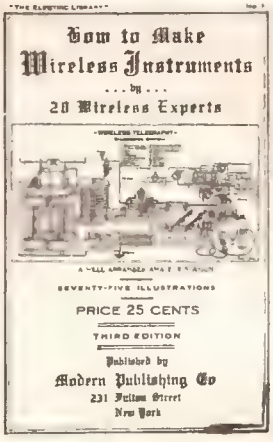
Q. Will you please let me know the wave length of my aerial, which is 62 feet long, 4 wires, 45 feet high at one end and the other end is about 25 feet? My lead-in is about 45 feet.

A. About 140 metres.

KNAPP DYNAMO ON A. C.

(2349) Lowell P. Hoyt, Maine, writes:

Q. 1. I have a Knapp Type "S" dynamo, which I am using on 6 volts alternating cur-



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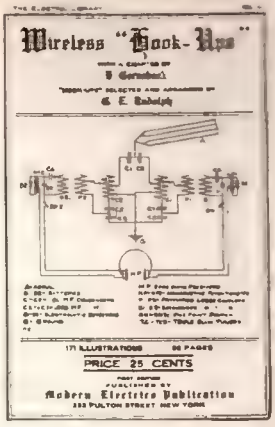

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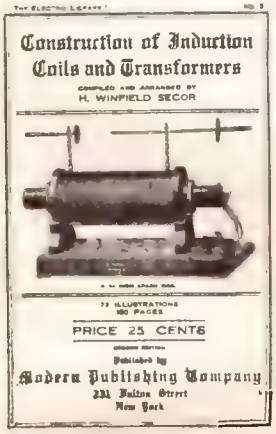

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rent. I have adjusted the brushes carefully, but it will not run at a speed of more than 300 r.p.m. Is there any way that this dynamo can be made to run as a motor at a higher speed?

A. 1. This motor cannot be run successfully on alternating current on account of the field being made of solid iron and the windings not designed for A. C. use.

Q. 2. Will this dynamo work (as a motor) as well on direct current from a rectifier as on direct current from a battery or a direct current dynamo?

A. 2. The motor may be made to operate fairly satisfactorily on direct current from a rectifier, provided a couple of choke coils be inserted, one in each of the motor leads. Direct current from a rectifier, while it is all flowing in one direction, is by no means the same as direct current furnished by a battery or a direct current generator, but is pulsating, and this pulsating current is almost as bad for motor operation as alternating current unless choke coils are used as described. These coils tend to counteract the effect of the pulsating current and render it more nearly like the current from a battery.

Q. 3. Can I use an aerial of 6 wires, 280 feet long, with a lead-in about 135 feet long, in connection with a 1-kw. transformer coil and still have a wave length of less than 200 metres?

A. 3. Yes. If you use a series condenser in the aerial lead. See article on the Wireless Amateur and the Wireless Law in the December and January issue of *Modern Electrics*.

AERIAL ON CHIMNEY

(2350) Jas. LeRoy Hodges, Mississippi, asks:

Q. Would a brick smoke stack 125 feet high be good to swing an antenna from? As hot air is a good conductor of the waves, it seems like the heat would absorb and conduct them to the ground. Please let me know what effect this would have?

A. This would make a fine aerial support, the only drawback being that it may be equipped with a lightning rod, which would cut down the efficiency of the aerial to some extent. Otherwise, you could hardly expect to get anything better as an aerial support. The hot gases going up through the stack will have little or no effect on the efficiency of the aerial.

RECEIVING SET

(2351) J. D. Fender, Nebraska, writes:

Q. I wish to install a wireless receiving set, and expect to buy some expensive goods. I would like a little information before starting out, as I am a reader of *Modern Electrics*, and had some work along this line. I am located 31 miles west of Omaha, half way between Omaha and Lincoln. I am almost in the center of the United States. Now, then, my aerial will be four No. 8 copper wires, each 3 feet apart, 80 feet high at both ends, with heavy electric light insulated wire leading to my receiving set. My receiving set consists of a 220-volt antenna switch, one of J. J. Ducks' improved receiving transformers a Blitzen

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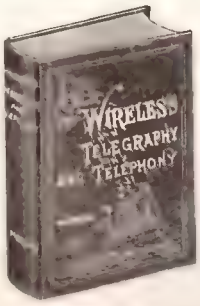

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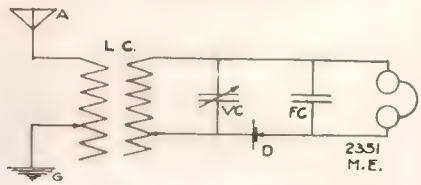
rotary variable condenser, a fixed condenser (Western Electric 2 mfd.), ferron, galena and silicon detectors and 2800 ohms transatlantic type receivers. I may increase the length of my aerial to 125 feet, however, can I get any long distances on this? Below is my idea of the hook-up. Have you any corrections to make, and is it proper?

A. Your receiving set appears to be O. K., except that the fixed condenser is much too big. One having 0.003 mfd. capacity would give very much better results; also, with these detectors, you will probably find the set will work better if the 'phones are connected across the fixed condenser, as shown in the diagram herewith. You should be able to do good work with this set.



OPEN CORE TRANSFORMER. AERIAL

(2352) Donald W. Davis, Colorado, asks:

Q. 1. Please give data on a ½-kw. open core transformer, using No. 30 enameled wire on secondary.

A. 1. Core, 11x1¼ inches; primary, two layers No. 14 DCC; secondary, 8 pounds in 26 pies ¼ inch thick; hard rubber tube ¼ inch thick between primary and secondary.

Q. 2. Is this aerial within the wireless law limits—5 wires, aluminum, 100 feet long, 50 and 6 feet above the earth? How many metres wave length has it?

A. 2. The aerial is within the law, so far as receiving goes, but as its wave length is almost 200 meters, you would have to use a series condenser in connection with it in order to properly couple it to the transmitting set through the oscillation transformer. See the article on the Wireless Amateur and the Wireless Law in the December and January issues of *Modern Electrics*.

Q. 3. How many metres can I tune to with above aerial and following tuner—3-slide, 225 feet of No. 20 DCC wire on tube 4½ inches in diameter.

A. 3. Probably 1000 metres.

SPARK COILS IN SERIES. PLACING AERIAL. WAVE LENGTH OF STATION

(2353) Henry Enrick, Ohio, Writes:

Q. 1. I am thinking of putting up a wireless set to communicate with a person seventeen miles away. I also expect to communicate with some friends about two miles away. At present I have not the money to buy a spark coil of sufficient size to send the long distance, and as no light or power current is available I could not use one of the E. I. Co.'s No. 8050 transformer coils, which is the only high ampere radiating appliance within my present means. So I have been figuring in my mind what would be the output of two 2-inch Bull Dog spark coils connected with the primaries in multiple with one vibrator

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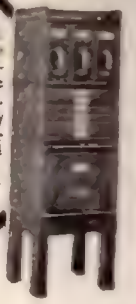

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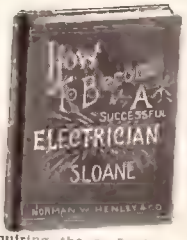

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crewed up tight and the other one between the batteries and the coils, and the seconds in series. You will probably see that I wish to get a set that will give enough spark for the two-mile work, and then when my means and experience are larger, I will buy a second coil and then increase my condenser and have the essential part of the sending set for the seventeen-mile work. Yet, at any time, I can uncouple the two coils and use one for the short distance, thus saving half of my battery cost. What is your opinion?

A. 1. The arrangement you describe would work after a fashion, but we would not recommend it. You might better get a coil similar to the 8060 coil of the E. I. Co., which is the same as the 8050 coil with the addition of a vibrator and a primary condenser. This coil takes no more battery power than a 2-inch coil, and the results for wireless purposes are very much better; also, it probably would send farther than the two 2-inch coils connected in series.

Q. 2. One mile south of me is a 3-cable high tension transmission line, which is to supply current to Toledo from the Anglaze Power Co. of Defiance. This current is of a very high potential. I do not know just what voltage it is or what amperage, but it must be high, as the cables weigh 2800 pounds each to the mile. The person seventeen miles away is almost straight south of me, the transmission line being between us. Do you think that the above transmission line would cause us any trouble about sending or receiving? Will say the cables are on 35-foot iron towers in the country, while in town they are on 60-foot lattice towers. Those nearest me are the small ones. State how the antenna should be put up in order to kill induction best?

A. 2. If you will place your aerial so that the horizontal part points north and south you will probably have no trouble from the high tension power lines mentioned. For the best results, you had better take your lead-in from the south end of the aerial.

Q. 3. In a general way, state how to determine the wave length of the station?

A. 3. The sending wave length in metres of the aerial alone is roughly 4/3 the length of the aerial plus the length of the lead-in and the ground wire in feet. To this would be added about 50 meters for the inductance in the secondary of the oscillation transformer. Of course, if you use, in addition, a loading inductance the wave length will be still greater by an amount depending upon the inductance of the loading coil.

HOOK-UP. WAVE LENGTH

(2354) Ernest G. Underwood, California, asks:

Q. 1. Will you give me a hook-up for the following instruments: Three ½-inch spark coils, oscillation transformer, glass plate condenser, spark gap, DPDT switch and key?

A. 1. Diagram herewith:

Q. 2. What is the wave length of an aerial 50 feet long, 4 wires 18 inches apart,

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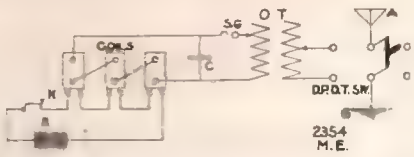
lead-in 40 feet long, aerial 30 feet high, lead to ground 5 feet?



A. 2. Two hundred and seventy metres the way you have the wires connected.

SPARK COIL SECONDARIES

(2355) Paul H. Geiger, Michigan, writes: Q. 1. I have been looking for the dimensions of the spark coil secondaries of the Electro Importing Company. I have a Monegon (1-inch size, I think) coil primary and I would like to buy two secondaries to fit it. The primary is 6 inches by 3/32 inch, wound with about No. 20 enameled wire, and the old secondaries (two in number) are 2¾ inches long by 1⅞ inches in diameter, wound with wire like that which I enclose. I would like to know if the secondaries of the Electro Importing Company will fit this primary?

A. 1. None of the E. I. Co.'s secondaries, except No. 8080 block secondary, would go on your primary, as the holes are too small. The hole through the 8080 secondary is 1½ inches in diameter.

Q. 2. Where can I obtain the vibrator spring for this coil, with the platinum point, without the rest of the vibrator?

A. 2. You can probably obtain vibrator parts from most any of the supply houses advertised in our magazine.

TUNING COILS

(2356) Wilbur H. Simonson, New York, writes:

Q. 1. I connected my instruments as in answer to query No. 2281 of the Oracle, but find that the slider to ground does not alter the tuning any. Stations come in the same, no matter where it is. However, the other slider connected to the detector circuit tunes all right. Is this right? Does it matter if one rod is connected on one end, and the other on opposite end?

A. 1. The grounded slider tunes the aerial circuit, while the other slider tunes the detector circuit. It may be that your aerial is very large or long and your coil small, in which case the ground slider makes little difference in the tuning. No.

Q. 2. Please tell me how to adjust a 3-slide tuner according to hook-up given to query No. 2259 of the Oracle?

A. 2. The operation of a 3-slide tuner is similar to that of a loose coupler. The ground slider is moved back and forth to tune the aerial circuit. Then the distance between the other two sliders is adjusted to tune the detector circuit, after which these two sliders are moved along the coil, keeping them the same distance apart, to vary the coupling between the aerial and the detector circuits, in the same manner that you would vary the coupling of a loose coupler by pulling the secondary out of the primary and vice versa.

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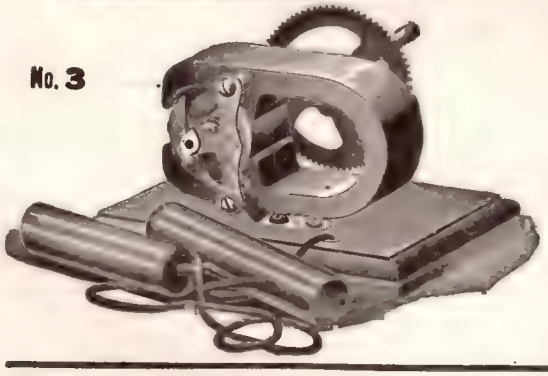

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Apparatus Exchange Department

As announced in our January issue, the Technical and Scientific Apparatus Exchange Department will appear from now on for the use of our subscribers and readers in order to exchange articles for which they have no further use for other articles which they need. There has been a long felt want among experimenters and amateurs for a department of this kind, and it is offered for the free use of our readers, as no charge is made for these advertisements.

As previously stated, advertisements of articles intended for sale cannot be accepted. Advertisements of this kind may be inserted in our regular paid classified advertising column. Advertisements under this heading containing more than fifty words cannot be accepted; the right is also reserved to rewrite or refuse to insert any advertisement which will not be for the best interests of our readers. Advertisements under this heading will be inserted one time only free of charge. Advertisements should be addressed to "Apparatus Exchange Department, care *Modern Electrics*, 231 Fulton St., New York.

WIRE—SINGLE SILK AND ENAMEL, FOR wireless coils, No. 28 and No. 34; will exchange for rotary condenser or other receiving instruments, or what have you? C. E. Apgar, Westfield, N. J.

WILL EXCHANGE A GOOD PAIR OF E. I. Co. amateur 'phones, 2000 ohm, for a Ferron detector or a 1-inch coil; write me. W. Ferguson, Box 449, Bordentown, N. J.

A FIRST CLASS HIGH SPEED 110-V. MOTOR, in excellent condition; just the thing for a rotary spark gap, and a 1-inch spark coil, to exchange. What have you? Motor measures 12x8x7 inches. Fred Lejewski, 1466 N. Ashland Ave., Chicago, Ill.

HAVE A TYPE S KNAPP DYNAMO MOTOR, practically new; will exchange for a pair of 2000 ohm head 'phones of standard make and in good condition, or other wireless apparatus I might need, of equal value. T. H. Uhland, 145 S. Garfield Ave., Pocatello, Idaho.

WANTED—8-INCH CYCLE A. C. FAN FOR $8 step-down Thordarson transformer. Secondary, 2, 6 and 8 volts. Cord was cut to insert switch. Enamel somewhat scratched, otherwise O. K., and almost new Spalding ball bearing roller skates. George Bliss, 2132 Bancroft Pl., Washington, D. C.

HAVE SET OF CYCLOPEDIA OF ENGINEERING, 5 vols., never used, half leather binding, cost $25; will exchange for wireless instruments of equal value. Would like ½-kw. sending outfit with rotary gap. John W. Pay, Milbank, S. D.

1-INCH SPARK COIL, ADJUSTABLE CONdenser, 6 tubes, spark gap, 20 ohm, Gernsback relay and coherer and decoherer; all these are of the Electro Importing Co. make, and are brand new; also have 6-volt, 60-ampere-hour storage battery, cost $25 new. I want a loose coupler, or what have you? Leonard Hursh, Union, Ore.

HAVE 2-V. MOTOR DYNAMO IN EXCHANGE for loose coupler or tuning coil; also have watch to exchange, or what have you? Stephen Anderson, Jr., [illegible] New York City.

HAVE OMNIGRAPH NO. 3, JUNIOR WITH 2 extra sets of discs; would like to exchange for spark coil or receiving apparatus. D. MacDonald, 43 Fourth Ave., Brooklyn, N. Y.

WILL EXCHANGE TWO GOOD ALTERNATING current hand generators and one Winchester repeating rifle for a good dynamo, direct current, similar to the E. I. Co. 6 v. 75 A. dynamo; also will exchange one good $8 microscope post card projector for a good E. I. Co professional head set, price $6.35. Address Alvin C. Spencer, Magnolia, Ill.

HAVE TWO 4x6-in. BATTERY (STORAGE) plates, also five 4x6-in. plates, without case; would like complete 2 party telegraph set, or what have you? Chas Unger, Harrison, N. Y.

A .005 M. F. VARIABLE RECEIVING CONdenser, a new lead peroxide detector, and either a "Bull's Eye No. 3" kodak or a Porter Motor No. 2; will exchange the three for an O. K. ½-kw. transformer coil. E. J. Grecian, Hill City, Kans.

A ½-K.W. TRANSFORMER, INTERRUPTER, spark gaps, key, and enough aluminum wire to construct a helix; will exchange for a good loose coupler of equal value; apparatus is in perfect condition. De Witt Smith, 609 N. College St., McKinney, Texas.

½-kw. WIRELESS SET, INDUCTIVE AND DIrect coupled, complete; have worked Chicago with it; will exchange for up-to-date Magic apparatus and illusions; have 18-inch to 25-inch spark Tesla coil, very fine; also have a lot of wireless goods and electrical apparatus of all kinds; what have you? C. O. Lorenz, P. O. Box 452, Port Arthur, Texas.

A BAUMGARTEN PRINTING PRESS WITH type, etc., in first class condition; prints form 6x9 inches; original cost, $35; will exchange for any of the following, so as to amount to $25 worth: 2000 ohm wireless 'phones; volt-ammeter (for switchboard); electrolytic detector; small dynamo; nickel-plating outfit; 6-inch water motor; 1-25-h.p. motor, and what have you? Gordon Weir, Springville, N. Y.

WILL EXCHANGE 1-INCH COIL, 500 OHM relay and Porter motor for 2000 ohm head set or rotary variable condenser; also one ½-inch coil for 1000 [illegible] receiver, or what have you? J. B. Worth, Cresskill N. J.

LARGE HOME-MADE LOOSE COUPLER, IN exchange for Knapp Type S dynamo; bargain. Another loose coupler and a loading coil, in exchange for 6 v. 60 A. H. storage battery, or what have you? First offer gets them. Earl U. Fisher, 1505 Fifth Ave., Pittsburgh, Pa.

WILL EXCHANGE A FINE 14-INCH ORCHESTra drum, including case, sticks, stand and music; an excellent instrument; cost $30; for a ¼-kw. closed core transformer, a variable condenser and a ferron detector, or what have you? Address Philip Wachtell, 47 Orchard Pl., Muncie, Ind.

WILL EXCHANGE ONE MOVING PICTURE machine for a 1-inch spark coil, static machine, or other electrical or wireless instrument of same value; machine cost $7.50 new; burns either oil or electricity; good as new. Julian Del Vecchio, Dyersburg, Tenn.

WILL EXCHANGE A COMPLETE WIRELESS outfit consisting of 1 receiving transformer, 1 detector, 2 variable condensers, 1 double head set, 2000 ohm, 1 spark coil, 1 helix, 1 spark gap, 1 aerial switch, 1 lighting switch, 14-wire phosphor bronze aerial 50 ft. long, for a 1912 motor cycle in good condition. Oscar F. Porter, 146 Warren Ave., Barnesville, Ohio.

CLAPP-EASTHAM FERRON DETECTOR, IN exchange for Brandes superior head set, Electro Importing Co.'s large variable condenser; will exchange for a good loose coupler, or what have you? Electro Importing Co.'s large tuner; cost $3.50; will exchange for something of equal value. Stanley Strauss, 5225 Lexington Ave., Chicago, Ill.

TO EXCHANGE—ONE STEEL LEVER KEY top connection, for permide of lead detector. Standard revolution counter for E. I. Co Universal detector, 75 ohm 'phone for Jr fixed condenser; also have an electrolytic detector and [illegible]

HAVE ARC LIGHT, 110-V. ALTERNATING OR direct current, home-made; foot power scroll saw; 12 copies 1912-1913 "Popular Mechanics" and No. 2 Brownie camera; all in good condition; in exchange for aerial switch, spark gap, wireless key, loose coupler and mineral detector. Donald C. Blanke, Greenwich, Conn.

WILL EXCHANGE PAIR "DAY AND NIGHT" field glasses, kodak, 4-section metal tripod, tripod adapter, 50 ohm relay, $1.25 baseball, not soiled, nickel-plated double head band; everything practically new; will trade for new Blitzen receiving transformer and latest ferron detector, or what have you to the value of $20? Crocker Mann, Dover, Mass.

WILL EXCHANGE FINE LOOSE COUPLER for small portable receiving set, without 'phone, or for a big tuner, double slide. Write to L. Austen, 316 East 165th St., Bronx, N. Y.

WILL EXCHANGE A "BABY" GASOLINE torch (almost new) and two telephone receivers, 75 ohms each, for variable condenser; also one small piece of silicon and one small piece of molybdenite for a piece of pyron, or what have you? Robert Bullock, Radio Station, York, Neb.

WHAT HAVE YOU TO EXCHANGE FOR mounted wireless receiving set consisting of 3-slide tuner, two variable condensers, loading coil, perikon, and galena detectors, mica brass foil 'phone condenser and buzzer test? Also pair magneto long distance 'phones, 2-inch telescope, both eyepieces and tripod attachment, 5x7 camera, with latest stereoscopic attachment. R. M. Wood, 636 South Grove Ave., Oak Park, Ill.

2000 OHM. HOLTZER-CABOT 'PHONES, DEtectors, spark coils, ¼-in. and 2-in. Mesco hot-wire meter, needs new resistance wire; Gen. Elec. make; jeweled movement; Poulson ticker, etc.; desire Eastman kodak, Roller skates with shoes, Blitzen rotary tuner, Murdock loose coupler; must be in good condition; what have you? W. Hollis Berry, 340 North Normal Parkway, Chicago, Ill.

WILL EXCHANGE FOR EQUAL VALUE, TENT, Winchester repeater, punching bag, kw. helix, 2½-inch coil, large variable sending condenser, double slide tuning coil, choke coil, $8 voltmeter, 1-10-hr. dynamotor; want good loose coupler, 2000 ohm Electro pro. 'phones, or what have you? Ray Wolf, care Postal Telegraph, Plymouth, Wis.

I HAVE A 22-CAL. STEPHENS CRACKshot rifle, in good condition, to trade for a 1000 ohm E. I. Co. amateur 'phones and a double head band, or for anything of equal value. Ray Harrison, 1319 15th St., Aurora, Neb.

A ¼-INCH SPARK COIL AND E. I. CO. PEroxide of lead detector and potentiometer, in exchange for a Blitzen rotary variable condenser or a 1-10 h.p., 60 cycle motor; also a 3 h.p. motorcycle engine in exchange for Brandes Navy type 'phones. Otis Keough, 4343 Lindell Blvd., St. Louis, Mo.

WILL EXCHANGE E. I. CO.'S CIRCULAR POtentiometer, E. I. Co.'s peroxide of lead detector, and Vail spark gap, for E. I. Co.'s Type S dynamo; instruments are in good condition. Samuel Carlyle, 614 Prairie Ave., South Providence, R. I.

MAKE ME AN OFFER FOR EXCHANGE ON the following: Thordarson flexible step-up transformer, Type H-2, brand new; 2-inch standard spark coil, with vibrator, almost new; Tesla transformer; helix, wound with No. 6 aluminum wire, 9 turns, mahogany mounted, almost new; all in perfect condition. W. B. Pope, P. O. Box No. 292, Athens, Ga.

TO EXCHANGE—WIRELESS AND ELECTRIcal apparatus for a camera taking post card size or larger pictures; also desire photographic apparatus. What have you? Willard S. Wilder, 800 Eighth Ave. W., Ashland, Wis.

FOR EXCHANGE—ONE 3-BAR MAGNETO AND one 4 bar magneto; also 110 volt, 60 cycle A. C. motor, for wireless goods, such as ferron detector or 3000 ohm 'phones, coils or other apparatus. Ralph Marbury, No. 9 Greenville St., Newnan, Ga.

WILL EXCHANGE 1-INCH BULLDOG SPARK coil, dynamo, unwound, with commutator, 10 volts at 1600 r.p.m., plates of 4 volts 60 a.h. storage battery, for relay telegraph instruments, ¼-inch coil or what have you? Harley Gooler, Box 24, Lamberton, Minn.

WILL EXCHANGE A 20 OHM TELEGRAPH set for anything of its cost, $1. Harold Hill, 93 Franklin St., Bristol, R. I.

WILL EXCHANGE MOTION PICTURE MAchine, valued, with films, at $10 (almost new), for a receiving or sending set, or part; or anything of same value in the electrical line. State what you have, and in what condition. V. Clements, 437 Lincoln Pl., Brooklyn, N. Y.

WILL TRADE E. I. ELECTROLYTIC DETECtor, with potentiometer, for good mineral detector. Kenneth Kingsbury, 24 Chestnut St., Binghamton, N. Y.

TELEGRAPH INSTRUMENTS, KEYS, SOUNDers, relays, plug switches, etc., in exchange for wireless apparatus; also two telephone sets, transmitters, receivers, induction coils, receiver hooks, in exchange for a good 20 ohm sounder and key. J. H. Mellon, Patton, Pa.

WILL EXCHANGE A MADE-TO-ORDER TESLA coil, cast in wax, enclosed in a solid mahogany case, 12x12x21, five taps to primary, gives 12-inch flame, cost $40, for two Murdock $15 loose couplers; or one Murdock $15 loose coupler and a 110 v. 1800 r.p.m. induction motor. Think this over. H. E. Rawson, 2 Apley, Cambridge, Mass.

BROWNIE CAMERA 2¼x3¼ INCHES, PREMO camera 2¼x3¼ inches; reflectoscope, throws pictures about 4 feet diameter; 15 different kinds of magazines; acetylene bicycle lamp; small photographic and wireless books, etc. I want a pair of 1000 ohm standard receivers, ¼ or ½ kw. transformer, dynamo, motor, or what have you? Arthur Van Pelt, New Athens, Ill.

GILLETTE SAFETY RAZOR, $5. NEW; EDISON records; hundreds of magazines—American, Everybody's, Cosmopolitan, etc.; for telephones or parts, electrical stuff or phonographs, typewriter, projector, Wimhurst static, etc. When writing, describe your articles fully. W. C. Borchsenius, Nye, Wis.

TO EXCHANGE — E. I. CO. TRANSFORMER coil and interrupter for good make 2-inch coil, or for Hunt & McCree 8.95 complete outfit; must be in good condition. Address Phil D. Stong, care Wireless, Keosauqua, Iowa.

WILL EXCHANGE TWO ½ KW. E. I. CO. transformers and a Gernsback electrolytic interrupter, all in good condition, for a good set of Brandes Navy type receivers, complete, with head band and cord. Boyce Miller, 401 South 15th St., Independence, Kans.

WILL EXCHANGE — ELEMENTARY CHEMistry laboratory with text-books and manual; Baush & Lomb double nose-piece; microscope; 1¼-inch Lemke Brigg's spark coil; E. I. Co.'s double head band and two 1000 ohm receivers and other electrical and scientific apparatus; want 1911 Harley-Davidson free engine, or what have you? Write for complete list. Dr. C. B. Herrmann, 4420 Vincennes Ave., Chicago.

WILL EXCHANGE THE FOLLOWING MAGAzines for a 1-inch spark coil: Electrician and Mechanic, 12 numbers of 1912, 7 numbers of 1911; Modern Electrics, November, 1911, to March, 1912, inclusive; Popular Electricity, June, 1911, to December, 1911, inclusive. Inquire of George F. Moulton, 111 Paul St., Ottawa, Ill.

WILL EXCHANGE A LONG DISTANCE WIREless Co. $20 loose coupler for a ½ kw. Wurts McKisson, Blitzen or Hl Thordarson transformer, or what have you? Address Fred Stringfellow, East Main St., N. Gainesville, Fla.

WILL EXCHANGE A 110 VOLT D. C. MOTOR, which is as good as new, for a variable receiving condenser or a static machine. E. Thompson, 316 West 105th St., New York City.

HAVE 16 WET BATTERIES TO EXCHANGE for a good loose coupler or either a 6 v. 6 a. storage battery or a helix with pilot lamp. I will give six of these batteries for an electro circular potentiometer, or what have you? Edward T. Bicak, 357 East 72d St., New York City.

A RAILWAY SET, CAR AND TENDER, switch, 40 sections of track, 1 cross track, 1 switch, 1 large battery motor, Porter No. 2 motor, I. E. Co. ½ kw. coil, 1 pair 2000 ohm receivers, one needs new diaphragm, Brownie No. 2-A camera, 5-inch film tank and a few other useful things. I desire good rotary sending outfit. Make offer. R. Hall, Peddie Inst., Hightstown, N. J.

WILL EXCHANGE BOOK, "ELECTRICITY FOR Young People," by Tudor Jenks, cost $3.50; one battery motor, cost $3; one telegraph set, sounder and key (Bunnell make); one telephone magneto, 3-bar; all in fine condition. Would like a spark coil, or let me know what you have. Robert P. Anderson, 702 Grand St., Troy, N. Y.

COMPLETE SENDING AND RECEIVING SET consisting of 2-inch Mesco coil, Mesco key, rotary and stationary gap, 100 ampere switch, antenna switch, Manhattan double and single tuning coils, Murdock variable condenser, Brandes superior 'phones (new), galena detector, Electro, Junior, condenser; cost $37. What have you to offer? A. J. Scott, 539 Gates Ave., Brooklyn, N. Y.

A BRAND NEW ½ KW. TRANSFORMER COIL to exchange for any of the following: ¼ kw. closed core transformer, loose coupler with rotary condenser, ½ kw. quenched gap, wave meter, hot-wire ammeter, Blitzen tuner, X-ray tube and flouroscope. What have you? B. Alan Mayhew, Tenafly, N. J.

BICYCLE WANTED IN EXCHANGE FOR 1-inch Ruhmkorff coil, spark gap, key, head band, receiver and cords, and double slide tuner. A. Edelmuth, 166 West 141st St., New York City.

WILL EXCHANGE PORTER MOTOR, IN EXcellent condition, very powerful, and rheostat, suitable for running miniature toys six speeds, for a good detector of either of the following makes—ferron, galena, or silicon, ferron or galena preferred. What have you? Write me. Kenneth Lynde, 20 Clorlia Terrace, Newtonville, Mass.

WILL EXCHANGE FOR WIRELESS APPAratus of equal value one $2.50 microscope, bought less than two months ago, and one $2 Eastman Brownie camera, takes good 2¼x3¼-inch pictures. Will exchange both or separately. John Sigvaldson, Box 352, Marshall, Minn.

FOR EXCHANGE — A PAIR OF 2000 OHM Brandes receivers; they have not been taken out of the shipping box. Address Lothrop Bailey, 22 Allerton St., Plymouth, Mass.

HAVE SPARK GAP, COHERER AND DECOherer, large helix, 150 ohm relay, sounder, water motor, and 6 v. dynamo, which water motor runs, to exchange for spark gap, wave meter, etc. Write your needs and what you have. J. E. Phinney, 832 Washington St., Dorchester, Mass.

HAVE A 115 VOLT, 1-7 H.P. MOTOR, COST $25, as good as new; will trade for E. I. Co. or Brandes 2000 receiver, with head band; detector, and 1½-inch coil, or what have you? R. W. Bender, 140 Laclede Ave., Youngstown, Ohio.

WILL EXCHANGE MESCO 1½-INCH WEATHerproof spark coil; loose coupler, primary 6 inches long, 4 inches diameter; two slides; secondary corresponding with nine taps; all woodwork ¾-inch quartered oak; Sireno horn (large size), with 6-inch flexible cord and brass push button, worth $15 or $20; also a door opener and four wet cells, complete (never used). Detectors, 'phones or variable condensers preferred. Write. D. Hutchinson, 501 West 157th St., New York.

A HOME-MADE 100 WATT, 110 VOLT, 60 cycle, A. C. step-down transformer; secondary output 2, 5, 10 15, 20, 25, 30 volts. Will exchange for 110 volt, 30 cycle, A. C. motor, or what have you of equal value? David Clackson, 693 Langside St., Winnipeg, Man., Canada.

A 20 OHM RELAY, MOUNTED ON A HARD rubber base, with rubber covered magnets, with 5 binding posts; also 1 sounder and 1 good detector, for ½ or 1 inch coil, or what have you? Sidney Morgan, 119 West York St., Savannah, Ga.

HAVE A POST CARD PROJECTOR, COST $4 when new; run on 110 v.; in fine condition; and a 2-pole hand magneto, would like to exchange the above for a pair of 2000 ohm Brandes superior or Murdock leader head sets, or what have you? Write Howard McMillin, West High St., Mt. Gilead, Ohio.

HAVE FOR EXCHANGE ONE VOLTAMP Type D battery motor, 6 volt, almost new; two 6 volt, 6 c.p. Tungsten lamps. Will exchange for small dynamo, or what have you? Jas. B. Root, R. F. D. 3, Reinholds Station, Pa.

AN EXCELLENT MINIATURE ELECTRIC traction car, size 9x5¼x4 inches. It has good spring brushes and runs easily. It is in first class condition, having used it but once. The price of the car was $2.35. Will exchange for zinc spark gap, key and detector, or what have you in the wireless line? Carl W. Rudell, 14085 Coit Rd., N. E., Cleveland, Ohio.

LOOK, MOTORCYCLE—EXCHANGE NEW 15-volt dynamo, $10 printing press, ½-kilowatt transformer, ringer set, combination detector, "Course in Hypnotism," pocket flashlight; all brand new and in fine condition; for a good motorcycle or something of equal value. Write me about it. Edward T. Chappell, Box O, Grand Ledge, Mich.

WILL EXCHANGE AN E. I. CO. 6 VOLT 60 ampere-hour storage battery registering 5 volts, in good condition, only needing to be recharged, for a good manufactured loose coupler, a rotary variable condenser or a good pair of 'phones, or what wireless instruments have you? Answer by mail only, T. H. Smith, Booraem Ave., Jersey City, N. J.

HAVE FOR EXCHANGE OR TRADE, LOOSE coupler, E. I. Co.'s electrolytic detector, fixed condenser, typewriter, 1-inch spark coil, 6-inch Geissler tube, buzzer, practice set, consisting of buzzer and key, mounted on hardwood base, Brownie kodak. Want a Murdock variable condenser or good set perikon crystals, or what have you to offer? Jas. L. Hodges, University, Miss.

WILL EXCHANGE — ONE TUNING LATHE; also complete receiving outfit for a flexible wireless transformer; also will accept a ½ kw. transformer coil as part on either of the above, or what have you? Ross Gunn, 369 W. Lorain St., Oberlin, Ohio.

FOR EXCHANGE—ONE SET OF MINIATURE telephones, in perfect condition, for some wireless apparatus. A. S. Boutilier, 25 Juniper St., Roxbury, Mass.

WILL EXCHANGE FOR ROTARY SPARK GAP to run on 6-25 volt D. C., or something of equal value and use to me; one magneto, induction coil, 75 ohm receiver, and two automatic switch hooks; all used in telephony, and in good condition. Oscar Anderson, 11815 State St., Chicago, Ill.

EXCHANGE—14-INCH SPARK COIL, ELECTROlytic interrupter, with platinum point, for motorcycle; also 2 kw. helix. What have you to offer? Write to F. J. Suchanek, 403 East 70th St., New York City.

EXCHANGE FOR MOTORCYCLE — WIRELESS set as follows: Large imitation mahogany table, 1200 ohm receiver and head band, 1800 meter tuning transformer, condenser, silicon detector, large quick throw intercommunication switch, variable and fixed condensers, 1-inch spark coil, key and Knapp Type S dynamo. W. O. Sargent, 19 Bellevue St., Lawrence, Mass.

WILL EXCHANGE A POST CARD PROJECTOR, used but twice, cost $3.00 for a spark coil or voltammeter of equal value, or what have you? C. M. Breder, Jr., 43 South Ninth St., Newark, N. J.

IN EXCHANGE FOR BRANDES TRANSATLANtic or Holtzer-Cabot 3000 ohm 'phone set; loose coupresponds to 1200 meters, with ordinary aerial, and finished in dark oak; practically new; also 60 watt open core transformer, secondary pies are 3-16 inch wide, and thoroughly wax impregnated. Both pieces of apparatus in excellent condition. White to F. M. Giffen, 33 Manchester ave., Paterson, N. J.

WILL EXCHANGE RUHMKORFF, 1-INCH coil, cost $14.00, for (Gernsbach Interrupter, Galena and peroxide of lead detector and loose coupler, not E. I., as I have one, or "What have you?" Gerritt Carl Zwart, Jr., Box 15, Glenbrook, Conn.

ONE REMINGTON TYPEWRITER IN GOOD condition; will exchange for standard make loose coupler. Also two sets of double spark coils suitable for wireless motor boat or automobile. Will exchange one for 6-volt, 60 ampere storage and one for water motor. Address Clare Dolan, 1402 6th Ave. S., Fort Dodge, Ia.

WANTED—A ½-KILOWATT TRANSFORMER, any reliable make for a No. 3 Eastman kodak and plate attachment, cost $30.00, also a Marlin repeating rifle, 22 calibre, for a Blitzen Var. Rotary Condenser and an improved Ferron Detector. Rifle cost $9.00. Five acetylene lamps, $1.00 each for a good key. Write at once, John Hoff, 172 Duncan Ave., Jersey City, N. J.

WILL EXCHANGE A CONLEY WIDE ANGLE lens for rotary variable condenser or spark coil. Lens in perfect condition and I will guarantee it to do first-class work. Also will trade a first-class, home-made enameled wire wound tuner, 5 inches in diameter and 12 inches long, for a first-class wireless 'phone, or what? Willard Hurley, R. F. D. No. 4, Box 34A, Hillsboro, Ore.

MURDOCK "A. M. SET," PEROXIDE OF LEAD detector, E. I. Co. 2000 ohm 'phones, aerial switch, key, helix, potentiometer, buzzer test and a very complete line of accessories. Will exchange for a good typewriter. Harold Hinshaw, 519 Keokuk St., Petaluma, Cal.

WILL EXCHANGE NICELY FINISHED LOOSE coupler for variable condenser, preferably "Blitzen." Photo of loose coupler sent on application. L. J. N. du Treil, 518 Eleonore St., New Orleans.

WANTED—TO EXCHANGE MOTION PICTURE machine, complete, perfect condition, for the best receiving and sending apparatus. Write in detail, A. A. Leichter, 261 Hancock Ave., Jersey City, N. J.

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WILL TRADE A COMPLETE WIRELESS transmitting outfit in excellent condition consisting of Key, 1" Coil, Helix, Condenser, Aerial Switch and Aerial Wire for an "Electro" ½ K.W. Coil with Vibrator or Interrupter or for a small 110 A. C. motor. Address, Howard S. Pyle, 3311 37th Ave., South, Seattle, Washington.

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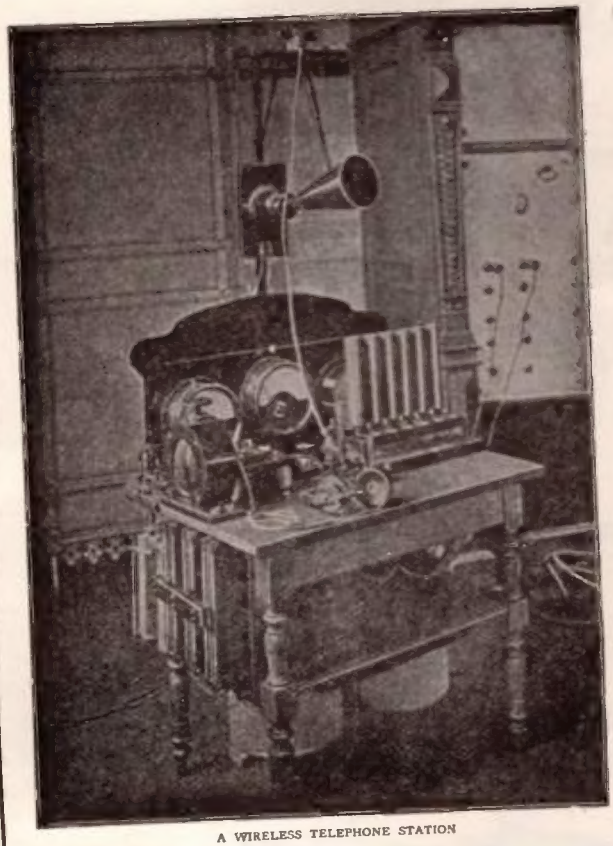

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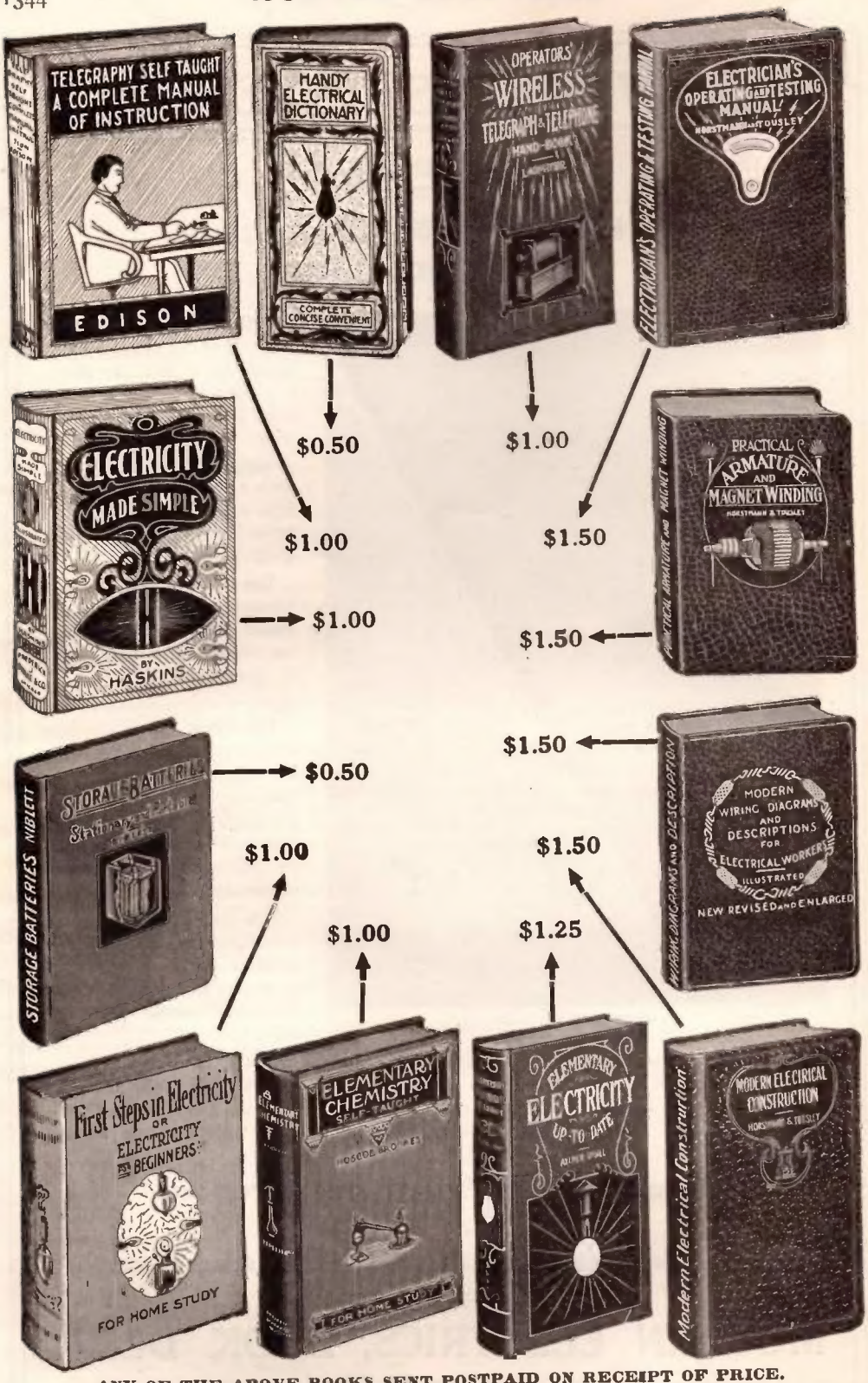

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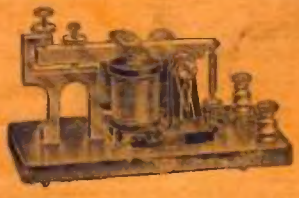

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